BALDOR®
GENERATORS

GLC Generator

(Gaseous Liquid Cooled)

GLC10, 15, 20, 25 30, 40, 45, 60, 65, 100 and 105

Installation & Operating Manual

2/08 MN2408

WARNING:
CALIFORNIA PROPOSITION 65 WARNING:

Engine exhaust from this product contains chemicals known to the state of California to cause cancer, birth defects and other reproductive harm.

WARNING:
CALIFORNIA PROPOSITION 65 WARNING:

Battery posts, terminals and related accessories are known to the state of California to cause cancer, birth defects and other reproductive harm.

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Section 1
Product Safety Information

Safety Notice **Be sure that you are completely familiar with the safe operation of this equipment. This equipment may be connected to other machines that have rotating parts or parts that are controlled by this equipment. Improper use can cause serious or fatal injury. Always disconnect all electrical loads before starting the generator.**

Installation and repair procedures require specialized skills with electrical generating equipment and liquid cooled engine systems. Any person that installs or repairs this generator must have these specialized skills to ensure that this generating unit is safe to operate. Contact Baldor service department for repairs or any questions you may have about the safe installation and operation of this system.

The precaution statements are general guidelines for the safe use and operation of this generator. It is not practical to list all unsafe conditions. Therefore, if you use a procedure that is not recommended in this manual you must determine if it is safe for the operator and all personnel in the proximity to the generator and connected loads. If there is any question of the safety of a procedure please contact Baldor before starting the generator.

This equipment contains high voltages. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the start-up procedure or troubleshoot this equipment.

This equipment may be connected to other machines that have rotating parts or parts that are driven by this equipment. Improper use can cause serious or fatal injury. Only qualified personnel should attempt the start-up procedure or troubleshoot this equipment.

- System documentation must be available to anyone that operates this equipment at all times.
- Keep non-qualified personnel at a safe distance from this equipment.
- Only qualified personnel familiar with the safe installation, operation and maintenance of this device should attempt start-up or operating procedures.
- Always stop engine before making or removing any connections.
- Always stop engine and allow it to cool before refueling.

Responsibility When your generator is delivered, it becomes the responsibility of the owner/operator of the generator set to prevent unsafe conditions and operation of the equipment. Some responsibilities include (but are not limited to) the following:

1. It is the responsibility of the owner/operator of this generator to ensure that this equipment is correctly and safely installed.
2. It is the responsibility of the owner/operator of this generator to ensure that this equipment, when installed fully complies with all federal, state and local codes.
3. It is the responsibility of the owner/operator of this generator to ensure that any person operating this equipment has been properly trained.
4. It is the responsibility of the owner/operator of this generator to ensure that any person operating this equipment has access to all manuals and information required for the safe use and operation of this equipment.
5. It is the responsibility of the owner/operator of this generator to ensure that it is properly maintained and safety inspected at regular scheduled intervals.
6. It is the responsibility of the owner/operator of this generator to ensure that any person who has not been trained on the safe use of this equipment does not have access to this equipment.

Read This Manual Thoroughly

If you do not understand any concept, any procedure, any safety warning statement, any safety caution statement or any portion of this manual, contact Baldor or your nearest authorized Baldor representative. We are happy to make sure you understand the information in this manual so that you can safely enjoy the full use of this generator.

Symbols

This symbol is shown throughout the manual to indicate a connection to ground reference point.

Indicates a potentially hazardous situation which, if not avoided, could result in injury or death.

Indicates a potentially hazardous situation which, if not avoided, could result in injury or death.

Precaution Statements Used In This Manual

There are three classifications of precautionary statements used in this manual. The most critical is a **WARNING** statement, then the **Caution** statement and the least critical is the Note statement. The usage of each statement is as follows:

WARNING: Indicates a potentially hazardous situation which, if not avoided, could result in injury or death.

Caution: Indicates a potentially hazardous situation which, if not avoided, could result in damage to property.

Note: Additional information that is not critical to the installation or operation.

IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS - This manual contains important instructions for the generator that should be followed during installation, operation and maintenance of the generator and battery (batteries). For ease of reading, the Warning statements are divided into four categories: Operation, Burn, Installation, and Maintenance.

Operation

WARNING: Never operate this generator in a manner other than as described in this manual. Operation in any manner not described in this manual should be considered unsafe and should not be attempted. Never start the engine unless you have first verified that the installation and operation of the generator are as described in this manual.

WARNING: Be sure that you are completely familiar with the safe operation of this equipment. This equipment may be connected to other machines that have rotating parts or parts that are controlled by this equipment. Improper use can cause serious or fatal injury.

WARNING: Exhaust fumes/gases are extremely dangerous and can cause severe illness or death. Never breath exhaust fumes produced by a running engine. Only run the engine outdoors where ventilation is plentiful. Exhaust gases contain carbon monoxide, a colorless, odorless and extremely dangerous gas that can cause unconsciousness or death. Symptoms of carbon monoxide poisoning include: dizziness, nausea, headaches, sleepiness, vomiting or incoherence. If you or anyone else experiences these symptoms, get out into fresh air immediately. Stop the engine and do not restart the engine until it has been inspected and if necessary repaired or reinstalled in a well ventilated area.

WARNING: Hot exhaust gasses must never be directed toward anything that may catch fire or explode.

WARNING: This generator must not be used on or near any forest covered, brush covered, or grass covered land unless the engine's exhaust system is equipped with a spark arrestor. The spark arrestor must be maintained in effective working order by the operator.

WARNING: Some parts of this generator rotate during operation. Rotating parts can present extreme danger if clothing or body extremities are caught by the rotating part and can cause serious or fatal injury. Never touch a part of the generator until the engine has been stopped and all rotating parts are completely stopped. Also, disconnect the spark plug wires and battery connection to prevent accidental engine rotation during servicing.

WARNING: Never move a generator set that is running. Loads should be connected and position secure before starting the engine. Hazards are caused by moving a generator set that is running.

Continued on next page.

Operation Warning Statements Continued

WARNING: Never connect or disconnect loads during operation. Always connect load circuits before starting the engine and use external branch disconnects etc. to switch loads On/Off.

WARNING: Be sure that you understand how to stop the engine quickly in case of an emergency situation. Become familiar with the controls and safety systems provided with this generator set.

WARNING: Always wear safety glasses with side shields and hearing protection when working near the generator.

WARNING: Improper operation may cause violent motion of connected equipment. Be certain that unexpected movement will not cause injury to personnel or damage to equipment.

WARNING: Never operate the generator set indoors or in a poorly ventilated area such as a tunnel or cave. Exhaust fumes are extremely dangerous to all personnel that are in or in contact with that area.

WARNING: Never permit anyone to operate the generator without proper instructions. Be sure to keep a copy of this manual with the generator so that all users can be properly informed of its safe operation.

WARNING: Never allow children or pets to be in the area where the generator is running. The generator and the equipment being powered by the generator may cause injury or death.

WARNING: Never operate the generator unless all guards, covers, shields and other safety items are properly installed.

WARNING: Do not put hands, feet, tools clothing or other objects near rotating parts such as drive shaft, pulley, belt etc. Rotating parts cause extremely dangerous situations because they can catch loose clothing or extremities and cause serious or fatal injury.

WARNING: When operating this generator remain alert at all times. Never operate machinery when physically or mentally fatigued, or while under the influence of alcohol, drugs or medication.

WARNING: Never operate the engine when the air cleaner is removed. An engine backfire can cause serious burns.

WARNING: Never "jump start" a generator to start the engine. If the battery charge is insufficient to start the engine, charge or replace the battery and try to restart. Jump starting a battery can cause the battery to explode and cause severe injury or death to anyone in the area.

WARNING: High voltage is present whenever engine is running. Electrical shock can cause serious or fatal injury. Never operate electrical equipment while standing in water, on wet ground or with wet hands, feet or shoes or while barefoot.

WARNING: High voltage is present whenever the engine is running. Electrical shock can cause serious or fatal injury. Always stop engine before connecting or disconnecting power cords or external devices.

WARNING: Do not smoke near generator during operation or when close to fuel source. LPG and natural gas fuels are flammable and can cause fire, explosions, injury or death.

WARNING: Keep generator at least three feet away from buildings and other structures.

WARNING: Keep generator away from flammable or hazardous materials (trash, rags, lubricants, explosives, paints etc.) and grass or leaf build up.

WARNING: Keep a fire extinguisher near the generator while generator is in use. An extinguisher rated "ABC" by the National Fire Protection Association is appropriate.

Burn

WARNING: Parts of this generator are extremely hot during and after operation. To prevent severe burns, do not touch any part of the generator until you have first determined if the part is hot. Wear protective clothing and after use allow sufficient time for parts to cool before touching any part of the generator.

WARNING: Do not touch the hot exhaust parts or the high voltage spark plug or coil terminals of the engine. Although spark plug voltages are not normally lethal, a sudden involuntary jerk of the hand or body part caused by contact with high voltage or a hot surface can result in injury to yourself or others.

WARNING: Engine coolant is under pressure and is near the boiling point of water when engine is hot. Do not open the coolant system until the engine has completely cooled. Hot coolant can cause severe burns and other injuries. When engine is cool, coolant level can be checked.

Continued on next page.

Warning Statements Continued

Installation

WARNING: Installation and servicing of batteries is to be performed or supervised by personnel knowledgeable of batteries and the required precautions. Keep unauthorized personnel away from batteries.

WARNING: Disconnect the battery's ground terminal before working in the vicinity of the battery or battery wires. Contact with the battery can result in electrical shock when a tool accidently touches the positive battery terminal or wire. The risk of such shock is reduced when the ground lead is removed during installation and maintenance.

WARNING: An open bottom stationary engine generator set must be installed over noncombustible materials and shall be located such that it prevents combustible materials from accumulating under the generator set.

WARNING: Installation and repair procedures requires specialized skills with electrical generating equipment and small engine systems. Any person that installs or performs repairs must have these specialized skills to ensure that the generator set is safe to operate. Contact Baldor for installation or repairs.

WARNING: Be sure all wiring complies with the National Electrical Code (NEC) and all regional and local codes or CE Compliance. Improper wiring may cause a hazardous condition and exposure to electrical hazards can cause serious injury or death.

WARNING: Be sure the system is properly grounded before applying power. Do not apply AC power before you ensure that grounds are connected. Electrical shock can cause serious or fatal injury. NEC requires that the frame and exposed conductive surfaces (metal parts) be connected to an approved earth ground. Local codes may also require proper grounding of generator systems.

WARNING: Place protective covers over all rotating parts such as drive shaft, pulley, belt etc. Rotating parts cause extremely dangerous situations because they can catch loose clothing or extremities and cause serious or fatal injury.

WARNING: Unauthorized modification of a generator set may make the unit unsafe for operation or may impair the operation of the unit. Never start a generator set that has been modified or tampered with. Be sure that all covers and guards are properly installed and that the unit is safe before starting the engine. If you are unsure, contact Baldor before starting the engine.

WARNING: When moving the generator, use reasonable caution. Be careful where you place fingers and toes to prevent injury "Pinch Points". Never try to lift a generator without a hoist or lift means because they are heavy and bodily injury may result.

Warning: Never connect this generator to the electrical system of any building unless a licensed electrician has installed an approved transfer switch. The national electrical code (NEC) requires that connection of a generator to any electrical circuit normally powered by means of an electric utility must be connected by means of approved transfer switch equipment to isolate the electrical circuit from the utility distribution system when the generator is operating. Failure to isolate the electrical circuits by such means may result in injury or death to utility power workers due to backfeed of electrical energy onto the utility lines.

WARNING: Circuit overload protection must be provided in accordance with the National Electrical Code and local regulations.

WARNING: Check Ground Fault Circuit Interrupt (GFCI) receptacles monthly by using the "Test" and "Reset" buttons.

WARNING: Only a professional experienced technician should install a fuel supply system. LPG and natural gas fuels are flammable and can cause fire, explosions, injury or death. Fuel supply lines should be kept away from sharp objects to prevent rupture. Comply with all NFPA regulations and local codes for shut-off valves, regulators, fuel line type, connectors etc.

WARNING: Have electrical circuits and wiring installed and checked by licensed electrician or qualified technician. Electrical shock can cause serious or fatal injury.

WARNING: Incorrect installation of this generator set could result in property damage, injury or death. Connection of the generator to its fuel source must be done by a qualified professional technician or contractor.

WARNING: An open bottom stationary engine generator set must be installed over noncombustible materials and shall be located such that it prevents combustible materials from accumulating under the generator set.

Continued on next page.

Warning Statements Continued

Battery Safety

WARNING: Installation and servicing of batteries is to be performed or supervised by personnel knowledgeable of batteries and the required precautions. Keep unauthorized personnel away from batteries.

WARNING: Do not dispose of battery or batteries in a fire. The battery is capable of exploding. If the battery explodes, electrolyte solution will be released in all directions. Battery electrolyte solution is caustic and can cause severe burns and blindness. If electrolyte contacts skin or eyes, immediately flush the area with water and seek medical attention quickly.

WARNING: Do not mutilate the battery . The battery contains electrolyte solution which is caustic and can cause severe burns and blindness. If electrolyte contacts skin or eyes, immediately flush the area with water and seek medical attention quickly.

WARNING: A battery presents a risk of electrical shock hazard and high short circuit current. The following precautions are to be followed when working on batteries:

1. Remove watches, rings, necklaces and all other metal objects.
2. Use tools with insulated handles.

WARNING: The battery electrolyte is a dilute sulfuric acid that is harmful to the skin and eyes. It is electrically conductive and corrosive. The following precautions are to be followed when working on batteries:

1. Wear full eye protection (safety glasses or goggles) and protective clothing.
2. Where electrolyte contacts the skin, flush the area immediately with water and wash it off using soap and water.
3. Where electrolyte contacts the eyes, immediately flush the eye thoroughly with water and seek medical attention quickly.
4. Spilled electrolyte is to be washed down with an acid neutralizing agent. A common practice is to use a solution of one pound (500 grams) bicarbonate of soda to one gallon (four liters) of water. The bicarbonate solution is to be added until evidence of reaction (foaming) has ceased. The resulting liquid is to be flushed with water and the area dried.

WARNING: A battery presents a risk of fire because they generate hydrogen gas. Hydrogen gas is extremely explosive. Never jump start a battery, smoke in the area around the battery or cause any spark to occur in the area around the battery. The following precautions are to be followed when working on batteries:

1. Do not smoke when near batteries.
2. Do not cause flame or spark in battery area.
3. Discharge static electricity from body before touching batteries by first touching a grounded metal surface.

Continued on next page.

Warning Statements Continued

Maintenance

WARNING: Before cleaning, inspecting, repairing or performing any maintenance to the generator set, always be sure the engine has stopped and that all rotating parts have also stopped. After stopping, certain components are still extremely hot so be careful not to get burned. Before servicing the generator set, be sure to disconnect the spark plug wires and the battery terminals to prevent accidental engine rotation or starting.

WARNING: Engine coolant is under pressure and is near the boiling point of water when engine is hot. Do not open the coolant system until the engine has completely cooled. Hot coolant can cause severe burns and other injuries. When engine is cool, coolant level can be checked.

WARNING: Before servicing the generator set, be sure to disconnect the spark plug wires and the battery terminals to prevent accidental engine rotation or starting.

WARNING: Inspect all wiring frequently and replace any damaged, broken or frayed wiring or wires with damaged insulation immediately. Electrical shock can cause serious or fatal injury.

WARNING: Disconnect all electrical wires and load devices from generator power outlets before servicing the generator. Electrical shock can cause serious or fatal injury. Always treat electrical circuits as if they are energized.

WARNING: Check all fuel supply piping, and their connections monthly for fuel leaks. LPG and natural gas fuels are flammable and can cause fire, explosions, injury or death. If a leak is found, replace only with approved pipe or components.

Caution Statements

Caution: Avoid installing the generator set beside heat generating equipment, or directly below water or steam pipes or in the vicinity of corrosive substances or vapors, metal particles and dust. Heat can cause engine problems to develop and unwanted substances can cause rust or generator failure over time.

Caution: Do not apply high voltage to windings (do not start the generator) in a moisture-saturated condition. Moisture can cause insulation breakdown, making it necessary to return the generator for repair.

Caution: Use only original equipment or authorized replacement parts. Using the correct parts will assure continued safe operation as designed.

Caution: Do not support the generator from the top of the frame or enclosure.

Caution: Do not tamper with or change the engine speed. Engine speed is factory set to produce the correct voltage and output frequency.

Caution: Never operate the engine without a muffler. The engine is designed to have the correct exhaust components installed and operating without these components can present a fire hazard, cause excessive exhaust gases and cause damage to engine. Inspect muffler periodically and replace if necessary.

Caution: The Programmable Output Contacts selection must agree with the external control wiring prior to energizing the controller. Failure to do so may cause severe equipment damage.

Section 2
General Information

Thank you for purchasing your Baldor Generator Set. This manual contains information you need to safely and efficiently install and operate your generator set. During the preparation of this manual every effort was made to ensure the accuracy of its contents. This manual describes only very basic engine information. A separate owner's manual for the engine is supplied with this unit for your use. Please refer to the engine manual for information relative to engine operation, maintenance, recommendations and additional safety warnings.

Baldor Generators have earned the reputation of being high quality and dependable. We take pride in this fact and continue to keep our quality standards high on our list of priorities. We are also constantly researching new technological ideas to determine if they could be used to make our generator sets even better.

Baldor makes no representations or warranties with respect to the contents hereof and specifically disclaims any implied warranties of fitness for any particular purpose. The information in this document is subject to change without notice. Baldor assumes no responsibility for any errors that may appear in this document.

Limited Warranty

Baldor will replace or repair free of charge any part or parts of the generator of their manufacture that are defective in workmanship and materials for a period of time as set forth in the Warranty Period chart below. All Baldor products requiring warranty service shall be transported or shipped freight pre-paid to a Baldor Generator repair facility. Notification of the defect or problem, a description of the manner in which the Baldor generator is used, and the name, address and telephone number of the customer requiring warranty service must be included. Baldor is not responsible for removal and shipment of the Baldor product to the service center or for the reinstallation of the Baldor product upon its return to the customer, or any incidental or consequential damages resulting from the defect, removal, reinstallation, shipment or otherwise. Problems with Baldor products can be due to improper maintenance, faulty installation, non-Baldor additions or modifications, or other problems not due to defects in Baldor workmanship or materials. If a Baldor Generator repair facility determines that the problem with a Baldor product is not due to defects in Baldor workmanship or materials, then the customer will be responsible for the cost of any necessary repairs. Genset engines are covered under the engine manufacturers warranty. Proper engine maintenance is required. Any request for engine warranty or repair should be made directly with the engine manufacturers warranty center. See engine manufacturers data for applicable engine warranty periods and location of repair centers. This Limited Warranty and Service Policy represents Baldor's sole and exclusive warranty obligation with respect to Baldor products. Baldor's liability to a customer or any other person shall not exceed Baldor's sales price of the applicable Baldor product. BALDOR DISCLAIMS ALL OTHER EXPRESSED AND IMPLIED WARRANTIES INCLUDING THE IMPLIED WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE AND MERCHANTABILITY.

Warranty Period

Generator Series	Labor*	Parts
Portable Products (Premier, Powerchief, DG Series)	1 Year	3 Years
Towable Products (TS)	1 Year or 3,000 Hours	3 Years or 3,000 Hours
POW'R LITE Light Towers	1 Year or 3,000 Hours	3 Years or 3,000 Hours Light Fixture, Lamps and Ballasts are excluded from any warranty coverage
3600 RPM Standby Systems (Some AE Models)	1 Year or 1,000 Hours	3 Years or 1,000 Hours
1800 RPM Standby Systems (Some AE Models, DLC, GLC)	1 Year or 3,000 Hours	3 Years or 3,000 Hours
Industrial Standby Systems	1 Year or 1,000 Hours	2 Years or 1,000 Hours
Industrial Prime Power Systems	1 Year or 1,000 Hours	1 Year or 1,000 Hours
International	1 Year or 1,000 Hours	1 Year or 1,000 Hours

*For products covered under labor coverage, travel expenses will be allowed up to 7 hours straight labor or 300 miles, whichever occurs first, and only applies to permanently wired and mounted products (AE, DLC, GLC, IDLC).
You must save the purchase receipt. Proof of purchase, date, serial number and model number will be required for all portable and Towable products to qualify for any warranty consideration.
A start-up inspection form/warranty registration must be completed in its entirety and submitted to Baldor Generators within 30 days of start-up to qualify for any warranty consideration, excluding: Portables, Towables and Light Towers.

Important Be sure you are completely familiar with all Safety Instructions detailed in Section 1 of this manual. Do not proceed if you are unsure of any detail. Contact your Baldor Distributor, they are experienced and are happy to assist you and to answer your questions.

Installation Guidelines

The procedures presented in this manual are suggestions and it is the responsibility of the Owner/Operator to arrange for these procedures to be performed by licensed contractors according to all applicable codes including local codes for your Municipality/City/County and State. In addition to these suggestions, before installing your generator you should obtain the most up to date copies of the following documents from the National Electrical Code and other authorities:

- National Electric Code, Articles 230, 250, 445, 517, 700.
- National Fire Protection Association
  No. 30 - Storage, Handling and Use of Flammable Liquids.
  No. 37 - Stationary Combustion Engines and Gas Turbines.
  No. 99 - Essential Electrical Systems for Health Care Facilities.
  No. 101 - Life Safety Code No. Systems.
  No. 110 - 1985 Emergency and Standby Power Systems.
- NEMA MG1
- Local Codes applicable to Genset Installation. See your local building inspector.

NFPA (National Fire Protection Association (617) 770-3000 (includes NEC)
1 Batterymarch Park, Quincy, MA 02169-7471 USA

NEMA (National Electrical Manufacturers Association) (703) 841-3200
1300 N. 17th Street, Suite 1847, Rosslyn, VA, 22209 USA

Site Planning

Room Size

Open frame generators must be protected from the environment while having good ventilation and cooling. Here are some considerations for planning a generator room or enclosure:

- Never use the Genset room for storage as well.
- The room must be large enough to contain the genset and all the accessories, such as batteries and their charging system, transfer switch and other controls, and elements of the cooling and fuel systems.
- A minimum of 2 feet (preferably 4 feet), must be allowed on the two sides of the engine for service access.
- On the generator end of the engine, allow a space equal to the length of the generator (generator length only, not the entire genset).
- At the front of the engine, 4 feet of clearance is preferable. Allow clearance between hot parts of the system (exhaust) and structural members of the building.
- Certain safety and building codes may require the genset room not to be used to house any other mechanical or electrical equipment.

Room Location Often a separate building located on the site away from the main building is the most simple and cost effective. Major considerations when housing the genset in a separate building are:

- Maintain the building at a satisfactory temperature year round (to meet applicable codes).
- Assure the genset is not located so far from the emergency loads that reliability is compromised.
- The floor's load carrying capacity must be checked and must exceed the weight of the genset and its associated equipment.
- **Engine Cooling System**
  A genset with an engine mounted radiator is the least costly to install; however, the room must be located in a place where sufficient radiator cooling air can be brought into and exhausted from the room.
- **Exhaust System**
  The exhaust system must minimize exhaust restriction. Exhaust restriction must be limited to 3 in. Hg (76 mm Hg) maximum, to ensure proper engine operation. The exhaust system should be as short and have as few bends as possible.
- **Room Air**
  If the genset is cooled with an engine mounted radiator, and sufficient air is brought into and exhausted from the room to satisfy the radiator cooling requirements and the combustion air requirements, the room will not overheat when the genset is running.
  If a remote mounted radiator or a heat exchanger is used, and adequate air is circulated through the room to keep it at a reasonable temperature, there will be adequate air for combustion.
- **Fuel Tanks (Diesel Only)**
  Locate the fuel storage tank as near the genset as possible. This will minimize the cost of fuel system installation and will maximize fuel system reliability.
- **Controls and Transfer Switch**
  Locate the control switch gear as close to the emergency loads and the genset as practical. This will minimize the chances that a failure of the power line to the emergency load will go undetected. In locating the switchgear, accessibility for service and maintenance must be considered.
- **Genset Noise**
  Internal combustion engines produce noise, so the room should be located away from occupied buildings. In addition the genset room can be treated to reduce noise transmission. In locating the genset room, both engine, fan and exhaust noise must be considered.

  If noise within the genset room, or noise transmitted to the surrounding parts of the building are a concern, then the room must be made large enough to allow for installation of noise attenuating walls and noise absorbing walls.
  Light weight concrete blocks filled with sand or special “sound block” concrete blocks are commonly used. Noise attenuating, tight fitting windows and doors also help reduce noise transmission to the rest of the building.
  A double-walled room should be considered. Vibration isolators under the genset rails will also reduce the transmission of noise through the floor.
- **Code Requirements**
  Building and safety codes deal with engine location. These requirements are concerned with fire rated walls, a location that minimizes the possibility of damage to the genset and interruption of the emergency system due to storms, foods, fire, vandalism, etc.

  Codes often deal with the need to maintain certain temperatures in the genset room and with fuel system location. The most important codes in the USA are the National Fire Protection Association Code Numbers 99 and 110, but local codes must also be observed.

Foundation Design

WARNING: An open bottom stationary engine generator set must be installed over noncombustible materials and shall be located such that it prevents combustible materials from accumulating under the generator set.

Foundation Checklist

A. Evaluate if a separate, isolated foundation is required for the application.
B. Observe local codes on soil bearing capacity freezing and thawing.
C. Design the separate foundation for the genset and specify the appropriate concrete mix.
D. Determine if the application requires vibration isolators and if so, order as a factory option.

The foundation must be strong enough to support the weight of the genset and its associated equipment, must prevent any deflection of the genset base and absorb vibration produced by the rotating and reciprocating masses.

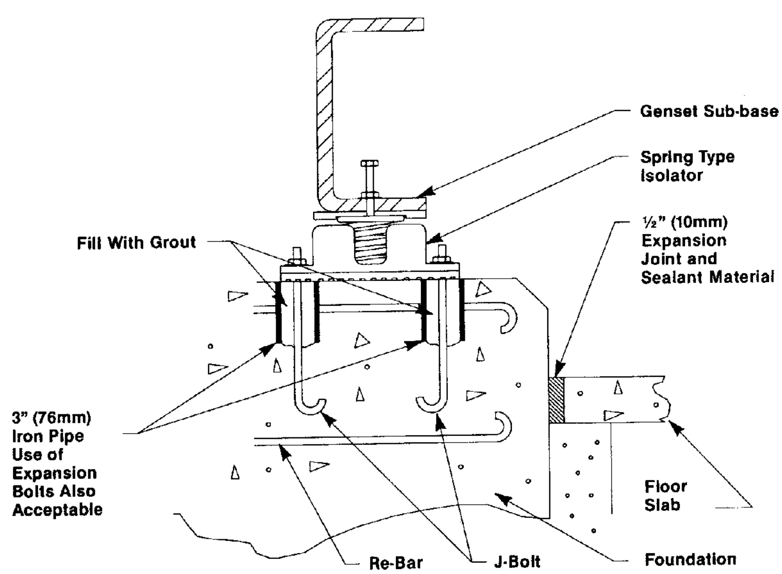
Setting The Genset On An Existing Concrete Floor Slab

- If an existing floor is used, the floor slab must be strong enough to carry 1.50 times the genset wet weight (including coolant and oil) to accommodate dynamic loads.
- The actual mounting arrangement (ie., surface area in contact with the floor) will determine the compressive strength required.
- The genset should be securely fastened to the floor slab with expansion anchors that fit the mounting holes shown on the genset installation diagram.
- For installations not expected to be permanent, elastomer pad with non-slip surface placed between the base and the floor will also prevent movement.
- Any floor/slab surface should be as flat as possible to prevent sub-base deflection.

Vibration Isolators

- Mounting to the pad, will result in overall reduced motion on other parts of the genset. The trade-off is that slightly more vibration is transmitted to the structure.
- A more common practice when mounting to a concrete pad is to use vibration isolators. The two most common types of vibration isolators are steel spring and elastomer pad. The primary purpose of vibration isolators is to reduce the noise and vibration which would be transmitted from the genset to the foundation or supporting structure.
- A simple and effective method of mounting and applying pad type isolators is to place non-skidding type isolation pads directly between the sub-base and floor.
  The number of pads required will be determined by the load bearing capability of the pads and the genset's weight.

Figure 2-1 Typical Installation of Spring Type Isolator



- Steel spring isolators are a very effective and commonly used. Steel spring isolators are typically 95-98% efficient (reduces the transmitted vibration 95-98%) while a pad type can be 75-88% efficient. Spring isolators also level the genset sub-base in the event the foundation pad is not perfectly level.

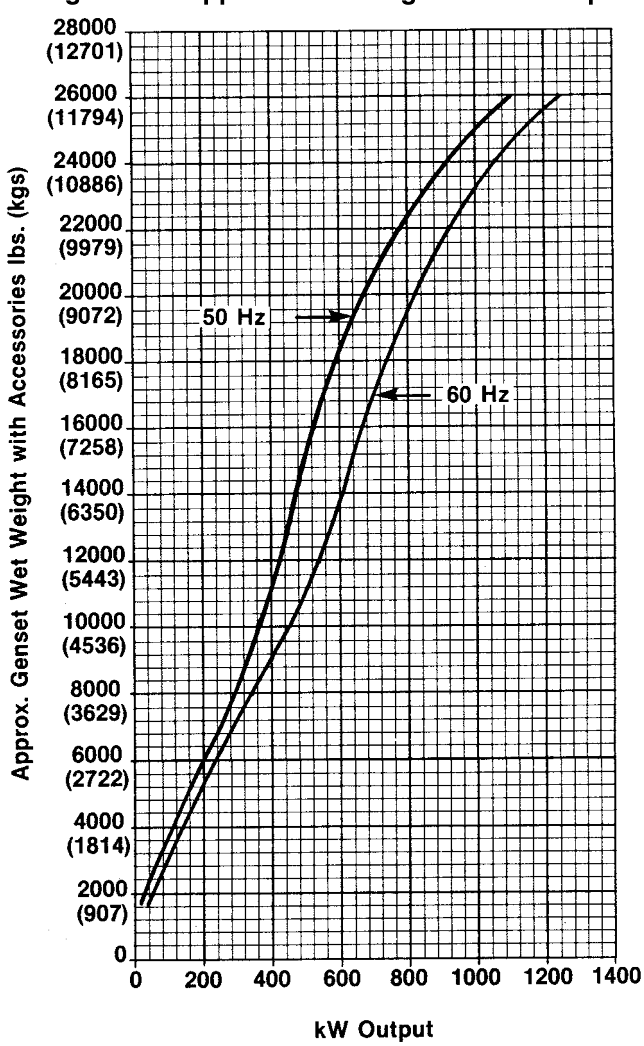
  Spring steel isolators offer the highest level of vibration isolation, however higher levels of vibration (although not detrimental) may be seen on some areas of the genset when mounted on steel springs, due to the (almost) total isolation from the foundation. The base of most steel spring isolators contains a non-skid pad. The base should be mounted to the foundation pad as shown in Figure 2-1 or as recommended by the isolator manufacturer.

  A common practice is to pour a concrete pad directly on top of the floor slab and to mount the genset on this pad. The purpose of the pad is to facilitate cleaning around the genset and to provide a more level base. When using this method, floor strength must support the pad and the genset. The pad should be at least 6in (150mm) thick and extend beyond the genset in all directions 12in (300mm).

Weight Of The Genset

The dry weight of the entire genset is shown on the Generator Set Specification Sheet. The wet weight includes the fluids (coolant and oil). Figure 2-2 can be used to design the foundation except in critical situations.

Figure 2-2 Approximate Weight vs. kW Output



Designing An Isolated Foundation

If the genset cannot be mounted directly on a floor slab, or if it is desirable to isolate it from the floor slab, then a separate foundation slab must be designed.

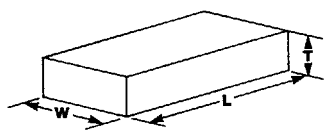
A massive concrete foundation is not required. Outside dimensions of the foundation should exceed the outside genset dimensions by 12in (300mm).

For single genset installation, the foundation weight should be a minimum of 1.50 times the genset wet weight.

For multiple genset installation, the foundation weight should be a minimum of 2.0 times the genset wet weight.

Figure 2-3 shows a method to calculate foundation thickness and the soil bearing load of the foundation and generator set. The soil load bearing capacity under the foundation must equal or exceed the load from the foundation and genset. If it does not, then a footing, as shown in Figure 2-4 must be added to spread the load over a larger area.

Figure 2-3 Calculate Soil Bearing Load (SBL) Capacity



$$T = \frac{W_T}{145 \times L \times W}$$

Where:
- T = foundation depth in feet (m)
- W_T = wet weight of genset in pounds (kg)
- 145 = density of concrete in pounds per cubic foot (2322 kg/m³)
- L = foundation length in feet (m)
- W = foundation width in feet (m)

$$SBL = \frac{TW}{W \times L}$$

Where:
- SBL = soil bearing load in lbs. per square foot (kPa)
- TW = total weight of the engine – generator, the foundation, and any other equipment that is supported on the foundation in pounds (kg)
- W = foundation width in feet (m)
- L = foundation length in feet (m)

Figure 2-4 Typical Footing on Foundation in Soil With Low Soil Load Bearing Capacity

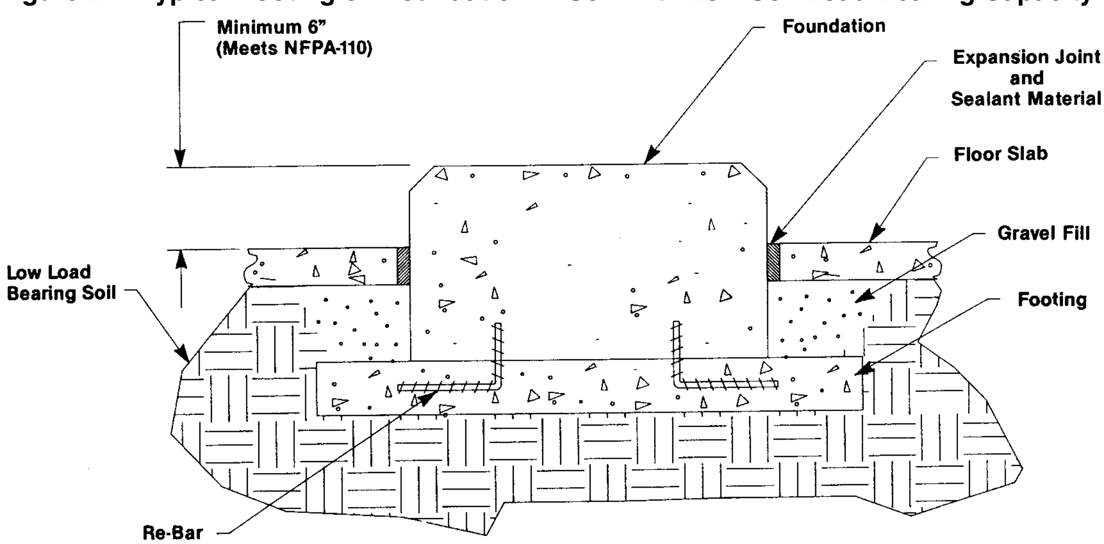


Table 2-1 Approximate Load Bearing Capacities of Various Soil Types

Soil Type	Safe Bearing Capacity	
	lb per ft^2	kilo Pascals
Hard Rock - Granite etc.	50,000 - 200,000	2,395 - 9,576
Medium Rock - Shale etc.	20,000 - 30,000	958 - 1,436
Hardpan	16,000 - 20,000	766 - 958
Soft Rock	10,000 - 20,000	479 - 958
Compacted Sand and Gravel	10,000 - 12,000	479 - 575
Hard Clay	8,000 - 10,000	383 - 479
Gravel and Coarse Sand	8,000 - 10,000	383 - 479
Loose, Medium and Coarse Sand	8,000 - 10,000	383 - 479
Compacted Fine Sand	6,000 - 8,000	287 - 383
Medium Clay	4,000 - 8,000	192 - 383
Loose Fine Sand	2,000 - 4,000	96 - 192
Soft Clay	2,000	96

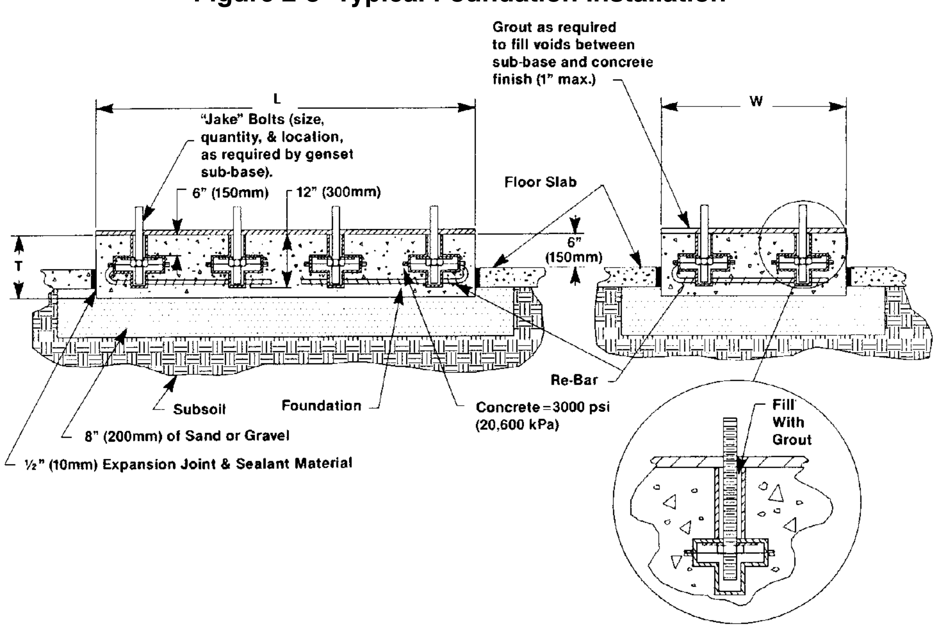
Table 2-1 shows approximate load bearing capacities for various types of soil if the actual load bearing capacity of the soil under the foundation is not known.

Caution: Check the local building codes for load bearing capacity requirements.

Caution: If the soil is subject to freezing and thawing, the foundation must be extended below the frost line. Check the local building codes.

- Reinforce the foundation with No. 8 gauge steel wire mesh placed horizontally on 6in (150mm) centers. As an alternative, use No. 6 re-bars on 12in (300mm) centers horizontally. Minimum cover over the bars should be 3in (76mm).
- Suggested concrete mixture by volume is 1 part cement, 2 parts sand, and 3 parts aggregate. Maximum slump of 4in (100mm) and a 28-day compressive strength of 3000 psi (20,600 kPa).
- The size of the bolts holding the sub-base to the foundation should be sized to fit the mounting holes shown on the Installation Diagram.
- Three-inch (76mm) iron pipe sleeves should be placed around the bolts in the foundation to allow for any mislocation of the bolts after the foundation hardens. “J” or “L” type bolts are recommended for the foundation bolts.
- After the foundation is cured and the genset is located, the sleeves are filled with grout. Figure 2-5 shows a typical foundation installation.

Figure 2-5 Typical Foundation Installation



Exhaust System

Exhaust Checklist

A. Exhaust outlets are not located upwind or near any building air intakes.
B. Flexible piping section is used at engine exhaust outlet.
C. Exhaust piping material is adequate for expected service.
D. Exhaust piping sizing is adequate to prevent back pressure.
E. Exhaust piping components are insulated as necessary to prevent operator burns and reduce pipe radiant heat losses.
F. Pipe sleeves or fire proof materials are used where exhaust pipe passes through building materials as per local and state codes.
G. Exhaust pipe includes rain cap or is horizontal.

The purpose of the exhaust system is to safely discharge the engine combustion products into the atmosphere outside the building. A silencer should be installed in the exhaust system to reduce noise levels. Compliance with local noise codes is always required.

Level Of Attenuation

In general, manufacturers offer three grades of silencers: industrial, residential, and critical. In most cases, these grades are comparable from make to make. However, attenuation curves for the silencer should be checked to assure the desired level of silencing is met.

System Placement

By this time, the general genset placement within the room or building has been decided. The routing of the exhaust system should be as direct as possible to the building exterior.

WARNING: Never allow the exhaust outlet to be positioned so that the exhaust gases are directed towards any openings or air entry routes (doors, windows, vents, etc...) of an occupied building. When discharging the hot exhaust gases out of the building do not direct them towards anything that could catch fire or explode.

For aesthetic reasons, consider exhaust placement in relation to the building. Over a period of time, exhaust gas carbon deposits will tend to accumulate on any nearby wall or structure. Attention must also be given to exhaust noise in selecting placement of the exhaust system.

Multi-Engine Installations

Caution: Do not connect multi-engine exhaust systems together. Each engine must have its own exhaust system for proper operation.

Exhaust gases from an operating engine will migrate back through a non-operating engine and cause a hydraulic lock. This may interfere with starting of the second engine. The migrating gases will also tend to turn the turbos which are not being provided lubrication if the engine is not running. The use of check valves in the exhaust system are discouraged due to their tendency to “stick”.

Exhaust Manifold

There are two exhaust manifold types. Dry type which is standard and the optional water cooled. The dry type is simply exposed to the surrounding air and becomes very hot. Shields, insulating wraps, or other types of guards can be used to limit operator contact with the hot surfaces. This practice is common where engine room size is small, creating cramped conditions.

Water cooled exhaust manifolds are not available on all engine models. This type manifold has passages through which engine coolant is circulated to remove heat from the manifold surface. It also will help protect the operator from contact with the hot manifold surface. This will reduce the amount of heat that is radiated by the engine to the surrounding air by approximately 20%. In addition, this type manifold significantly increases the amount of heat the cooling system must dissipate. Marine and Mining Safety Administration (MSA) codes may require water cooled manifolds in all genset installations. If you are in doubt on your particular application, consult your Baldor Distributor.

Exhaust Gas Restriction

The maximum allowable back pressure, or system restriction, is 3 inches of mercury. If this back pressure is exceeded, the air-fuel ratio is reduced due to incomplete scavenging of the cylinders, fuel economy and power output is reduced, engine life is reduced and exhaust temperatures and smoke levels increase. Any restriction of the exhaust gas reduces horsepower. Take every precaution to reduce restriction. Proper design and installation will provide safe genset operation.

It is essential that all engine exhaust systems by designed with the least possible restriction to exhaust gas flow. This can be calculated through the use of Figure 2-6, or in the case of simple exhaust systems, the nomograph in Figure 2-6 may be used.

Figure 2-6 Exhaust System Calculations

$$P\ (psi) = \frac{L \times S \times Q^2}{5{,}184 \times D^5}$$

$$P\ (kPa) = \frac{L \times S \times Q^2 \times 10{,}000}{0.0027787 \times D^5}$$

P = Backpressure (psi) (kPa)
psi = 0.4912 x inches Hg
kPa = 0.1333 x mm Hg
L = Length of pipe (ft) (m)
Q = Exhaust gas flow (cfm) (m^3/min.)
D = Inside diameter of pipe (in) (mm)
S = Specific weight of gas (lb-ft^3) (kg/m^3)

$$S\ (lb\text{-}ft^3) = \frac{39.6}{\text{Exhaust Temperature} + 460°F}$$

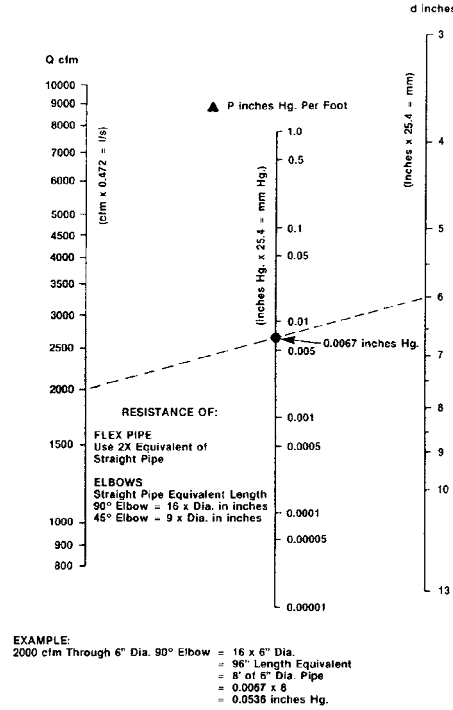
$$S\ (kg/m^3) = \frac{352.05}{\text{Exhaust Temperature} + 273.16°C}$$

To obtain equivalent length of straight pipe for each long radius 90° bend:

$L\ (ft) = 15 \times D$ $\qquad L\ (m) = 15 \times D$

$L\ (in) = \frac{15 \times D}{12}$ $\qquad L\ (mm) = \frac{15 \times D}{1000}$

The radius of 90° bends with radii 1½ times the pipe diameter help to lower resistance.



Exhaust Piping

Caution: The weight of the exhaust system must never be imposed on the turbo-charger outlet. Damage to the turbo-charger and other components may result.

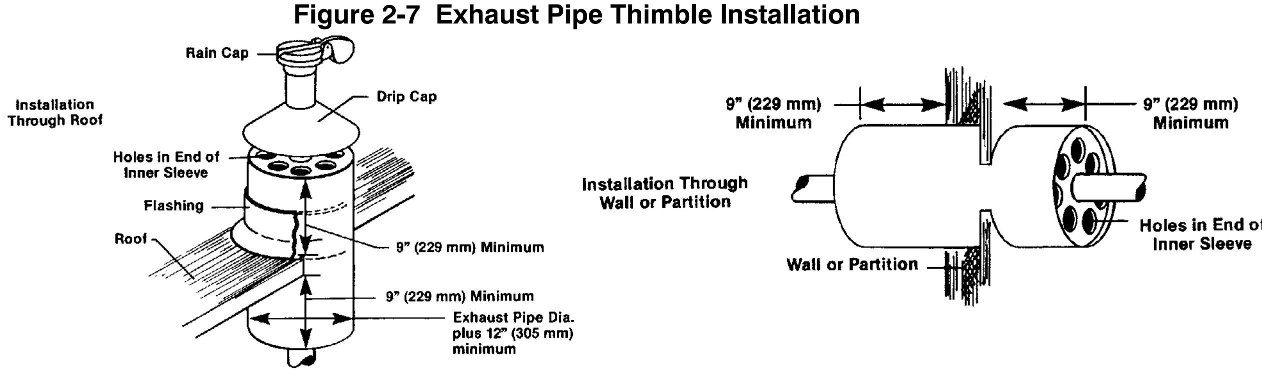
An exhaust system must withstand the vibration and thermal expansion that they are subjected to, yet supported well enough to remain independent of the engine.

The most common method of providing flexibility is with the use of bellows type flexible piping. This piping component allows lateral and linear movement of the piping system without subjecting fixed components to excessive stress. A minimum of 12 inches of flexible connection must be provided at the engine exhaust manifold to allow for thermal expansion and vibration. If the engine is to be mounted on spring type vibration isolators, increase the length to 24 inches. This component can be specified to be provided by your Baldor distributor. Flexible pipe should never be used for pipe bends or to cure misalignment problems.

Exhaust piping systems may be supported by a wide variety of methods to long as the system remains flexible, and capable of withstanding thermal expansion.

The material most commonly used for straight runs and elbows in exhaust systems is Schedule 40 black iron. If hanging weight is a problem, other materials may be used. Galvanized piping should never be used in exhaust system. Where exhaust piping passes through combustible material, exhaust thimbles must be used. See Figure 2-7.

Figure 2-7 Exhaust Pipe Thimble Installation



Rain Protection

Moisture entering the engine through an exhaust system can cause extensive damage. Exhaust outlets must have a rain cap or be horizontal to prevent such damage. See Figure 2-7.

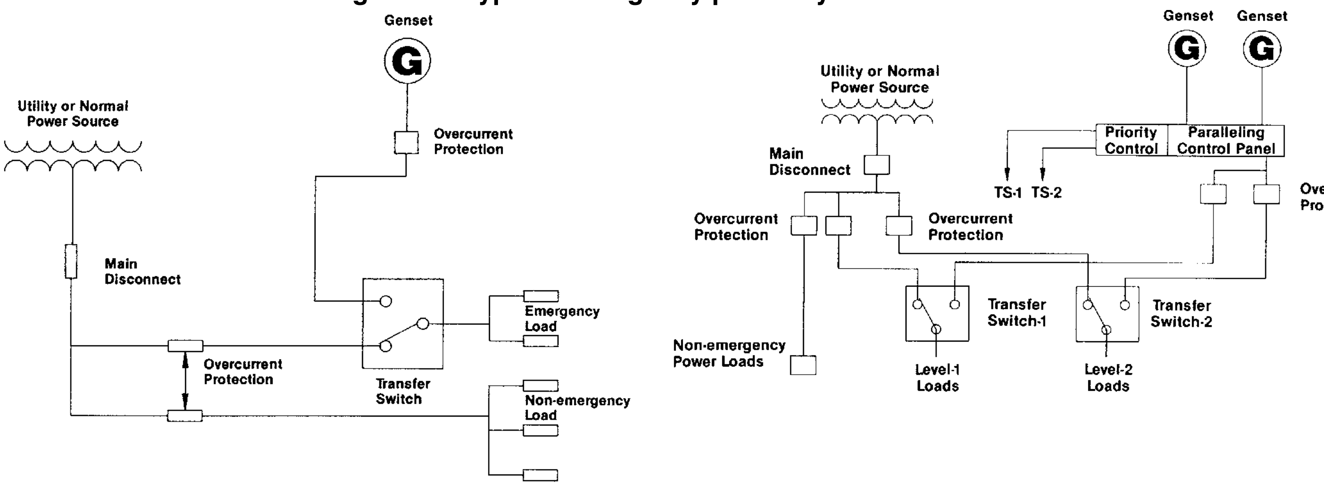
Transfer Switch

Transfer Switch Checklist

A. Locate transfer switch in a clean, dry place, near the emergency load.
B. Provide a circuit breaker between the genset and the transfer switch.
C. Put a flexible connection between the conduit and genset.
D. Observe applicable codes in wiring-in the transfer switch and genset.

The transfer switch connects the genset to the emergency power system. The emergency power system may include several gensets and several transfer switches. Typically, the genset is wired to the emergency power system through a transfer switch as shown in Figure 2-8.

Figure 2-8 Typical Emergency power System Installations



Multiple Gensets can be arranged either in parallel or separately connected to dedicated emergency loads. Figure 2-8 also shows a typical arrangement of two gensets in parallel with transfer switches for loads that have different levels of priority. A typical multiple genset installation is shown for NFPA 110 Level 1 and Level 2 emergency power circuits and a priority control to select the appropriate transfer switch.

Wattmeters should be installed on each genset so load sharing can be checked. The control system should include an automatic paralleling control. Paralleling identical gensets is not difficult, but paralleling dissimilar sets can cause load sharing problems. When designing an installation that includes the paralleling of dissimilar generators, contact your nearby Baldor Distributor.

Transfer Switch Location

The transfer switch location is important and key considerations are:

1. Locate the transfer switch as close to the emergency load as practical to avoid interruptions of the emergency power system due to natural or man-made disasters, or to equipment failures. Consider several small transfer switches instead of one large one to increase reliability.
2. Locate the transfer switch in a clean, dry, well ventilated location, away from excessive heat. When the ambient air is above 104 °F (40 °C), fuses and circuit breakers must be derated. Allow adequate working space around the transfer switch.
3. A circuit breaker (or fuses) should be installed in the line between the generator and the transfer switch. Baldor Gensets are available with properly sized circuit breaker built into the generator control through 1200 amp breakers. The circuit breaker can be separately mounted. In the case of very large circuit breakers, a separate floor mounted circuit breaker is easier to wire up than a wall mounted breaker.
4. Install power and control wires in separate solid conduit with flexible sections at the genset. The flexible sections prevent vibration from damaging the conduit. All power conduits from the genset must contain all three phases.
5. Never install control wires in the same conduit as power conductors.

6. Conduit, wire, circuit protective device sizes, insulation etc. must conform to applicable local and national codes and regulations.
7. Be certain to seal around conduits that penetrate the walls of the genset room to reduce the amount of noise that is transmitted to the surrounding areas of the building and maintain site fire code rating.

Battery Starting System

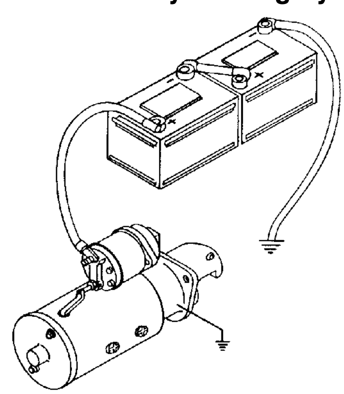
This section describes the battery starting system (nominal 12 volt rating of the battery supply) for the engine, battery charger, and precautions to take if the ambient temperature is expected to be below 70 °F (20°C).

WARNING: If batteries are not mounted in the battery rack supplied with the genset, protect batteries from vibration and do not locate them near a source of flame or spark. A battery presents a risk of fire and explosion because they generate hydrogen gas. Hydrogen gas is extremely explosive. Never jump start a battery, smoke in the area around the battery or cause any spark to occur in the area around the battery.

Battery Location

Locate batteries as close as possible to the genset to minimize starting circuit resistance, see Figure 2-9. High starting circuit resistance substantially reduces starting cranking ability. Mount batteries on a level rack away from dirt and liquids. Allow space for servicing (checking water level and level of charge). Cold ambient temperature at the battery location substantially reduces the battery output.

Figure 2-9 Battery Starting System



Battery Size

The ability to start the engine depends upon battery capacity, ambient temperature and coolant and oil temperatures. The Engine/Generator Set Data Sheet lists minimum recommended battery capacity.

Battery capacities decrease as ambient temperatures decrease so it is important to specify batteries with the appropriate CCA rating at a temperature no higher than the minimum ambient temperature for the application.

Battery Charger

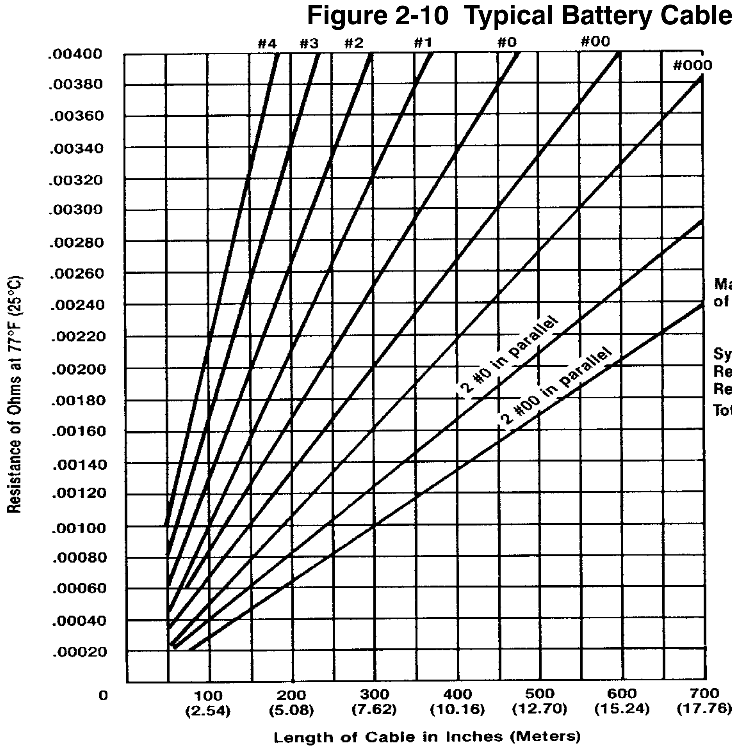
An engine mounted alternator charges the batteries during engine operation. Standby gensets should include a solid state battery charger that is connected to utility power so the battery is charged continuously while the genset is not running. The battery charger should be connected to the utility power emergency circuit. The batteries on prime power gensets are charged by the engine mounted alternator, if equipped.

The output of the battery charger or the belt driven alternator must be connected directly to the battery or to the battery terminals on the starter to prevent the electronic governor from acting erratically. Make control connections to the genset control using a conduit with a flexible section at the genset to avoid damage due to genset vibrations.

Battery Cables

The wire size (wire gauge) of the cables connecting the starter to the batteries must be large enough to ensure proper voltage at the engine starter motor during cranking. The total cranking circuit resistance includes the resistance of the cables from the starting motor to the battery and the resistance of all relays, solenoids, switches, and connections. The resistance of various sizes of cables is shown in Figure 2-10. For purposes of calculating cranking circuit resistance to select cable size, the resistance of each connection can be taken as .00001 ohms and the resistance of each relay, solenoid, and switch can be taken as .0002 ohms. Figure 2-10 illustrates an example of a typical cranking circuit resistance calculation.

Figure 2-10 Typical Battery Cable Calculations



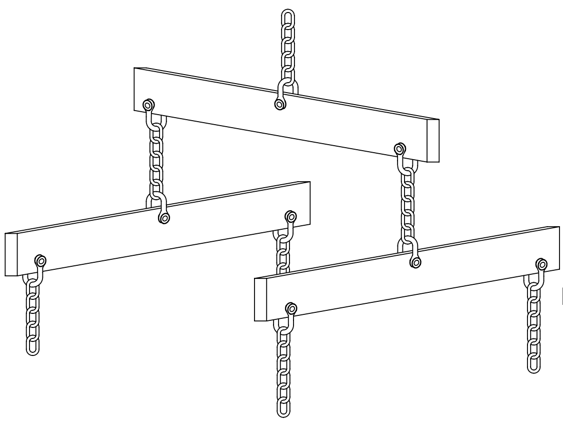
Maximum Allowable Resistance of the Cranking Circuit	0.002 Ohms for 24 Volt System 0.0012 Ohms for 12 Volt System
System voltage	24 Volt
Resistance of 6 Connections	0.00006 Ohms
Resistance of 100" of #1 Cable	0.00100 Ohms
Total Resistance of Cranking Circuit =	0.00106 Ohms

Receiving & Inspection When you receive your generator, there are several things you should do immediately.

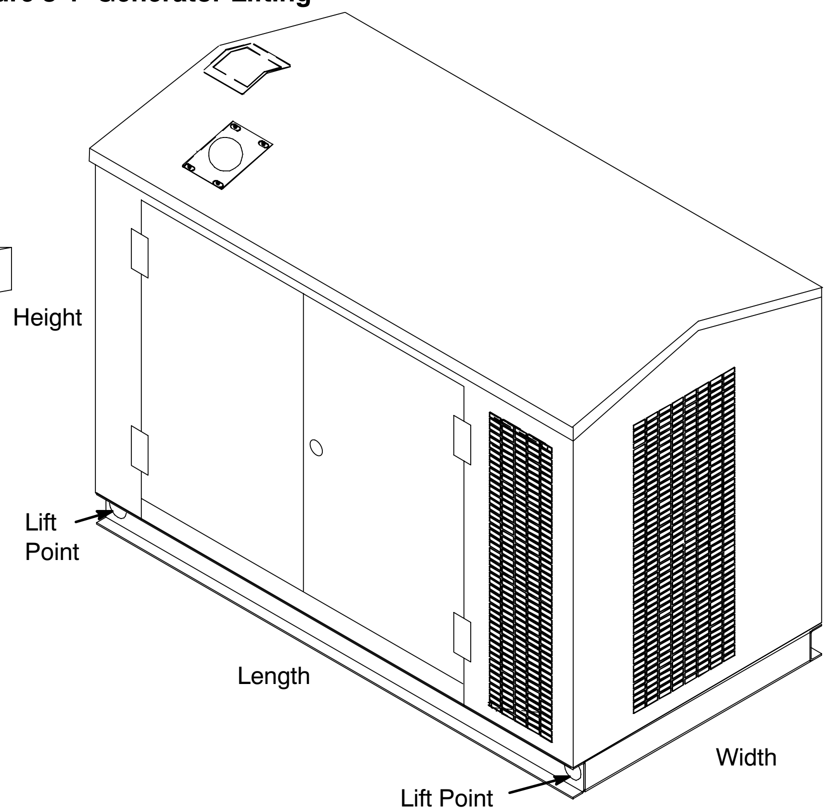
1. Observe the condition of the shipping container and report any damage immediately to the commercial carrier that delivered your system.
2. Verify that the part number of the system you received is the same as the part number listed on your purchase order.
3. If the system is to be stored for several weeks before use, be sure that it is stored in a location that conforms to published storage temperature and humidity specifications.

Lifting the Generator When lift or hoist equipment is used to lift the generator and move it to position, be careful not to contact overhead wires or other obstacles. Be sure lift or hoist equipment has appropriate tires for the terrain to avoid becoming stuck or tipping over. If the shipping pallet is intact, use a fork lift to move the generator. If the shipping pallet has been removed, use two steel pipes through the "Lift Point" holes to lift the generator. See Figure 3-1.

Figure 3-1 Generator Lifting



To lift the generator, always use spreader bars, chains, eyehooks and other hardware that is of sufficient strength to lift at least three times the weight of the generator.



Physical Location The mounting location of the system is important. It should be installed in an area that is protected from direct harmful gases or liquids, dust, metallic particles, shock and vibration. It should be installed in an outdoor location so the exhaust fumes are vented to the atmosphere.

When the Generator is installed outdoors
The factory installed enclosure is designed to keep out undesirable weather elements while providing cooling and ventilation.

When the Generator is installed in a building it is essential to provide:

1. Adequate control and exhausting of the heated air.
2. An adequate and constant supply of incoming cooling air.
3. Adequate control and discharge of the engine's hot exhaust gases.
4. Adequate ventilation of the building when the engine shuts down.

WARNING: An open bottom stationary engine generator set must be installed over noncombustible materials and shall be located such that it prevents combustible materials from accumulating under the generator set.

Several other factors should be carefully evaluated when selecting a location for installation:

1. For effective cooling and maintenance, the system should be mounted on a flat, smooth, noncombustible level surface. A concrete pad is ideal and provides a secure installation.
2. Installation should prevent water levels from reaching the generator. Drainage must be adequate to keep concrete pad free from standing water.
3. Installation should prevent obstructions by buildup of leaves, grass, sand, snow, etc. If these items pose a problem, consider building a small fence or other break to protect the unit from accumulation of debris.
4. Installation should place the generator as close as possible to the fuel supply and transfer switch.
5. At least twenty-four (24) inches clearance must be provided on all sides for air flow.
6. Access must be provided to allow the enclosure covers to be opened or removed for service and maintenance.
7. Maximum Ambient temperature is 122°F (50°C).

Figure 3-2 Generator Mounting

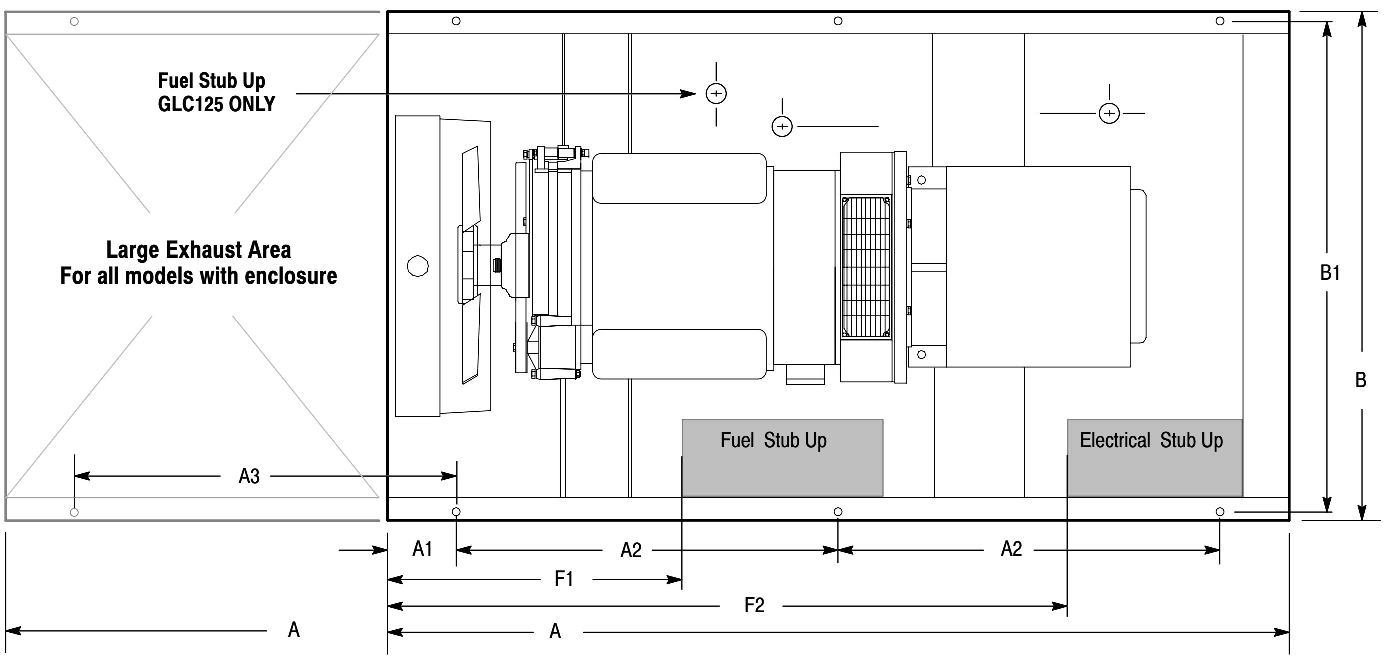


Table 3-2 Mounting Dimensions

Generator	A (Open)	A (Weather.)	A (Sound)	A1	A2	A3	B	B1	F1	F2
GLC10-25	60.25	72.0	72.0	4.0 [1]	26.1	11.75	31.5	30.5	17.6 [1]	34.2 [1]
GLC30-45	78.0	78.0	108.0	6.0	33.0	30.0	44.0	42.5	21	58
GLC60-65	88.0	88.0	118.0	6.0	38.0	30.0	44.0	42.5	23	63
GLC80-105	88.0	88.0	118.0	6.0	38.0	30.0	44.0	42.5	27	68

[1] Add 11.75 in for Weather & Sound Attenuated enclosures.

Table 3-3 Stub Up Detail

Generator	Stub Up Area		**Fuel Connection** (NG or LP Vapor)
	Electrical	Fuel	
GLC10-25	6.25" x 5"	5" x 18"	3/4" NPT, C/L is 3" above base bottom.
GLC30-45	15" x 6"	18"x 6"	3/4" NPT, C/L is 12" above base bottom.
GLC60-65	21" x 6"	20" x 6"	1- 1/4" NPT, C/L is 12" above base bottom.
GLC80-105	16" x 6"	21" x 6"	1- 1/4" NPT, C/L is 12" above base bottom.

Secure the Generator

Six (eight for the GLC125) mounting bolts in the base frame secure the generator to the shipping pallet. Remove these bolts, lift the generator and remove the shipping pallet. Secure the generator to the concrete pad using $^3/_8$″ anchor hardware (not provided) in the base frame mounting holes. See Figure 3-2. Anchor bolts must be long enough to extend through the generator mounting frame.

Engine Cooling A sufficient flow of clean, cool air is required for combustion and to dissipate the heat produced by the engine. Approximately 60% of the heat value of the fuel used is given off as heat (cooling air and exhaust).

The air that will cool the engine must be brought in from outside the building. A sufficient air-flow of rate "Cubic Feet per Minute" (CFM) will allow the incoming fresh air to cool the engine. This requires a power ventilation system of sufficient CFM to be located at the highest possible point of the building to exhaust hot air and draw in cool fresh air.

Note: The exhaust fan must not be located where it could easily become blocked by leaves, snow, water, debris, etc.

It is recommended that the cool air intake have at least three (3) times the cross-sectional area of the power ventilation system. It is also recommended that the cool air intake be located as close as possible to the top of the generator set.

The exhaust fan must be connected to the AC power terminals of the generator set so that when the generator set starts it will provide immediate cooling air flow. The fan will operate until the generator set stops. To test the ventilation system, do the following:

Ventilation Test

1. Place a thermometer as close to the cool air intake of the engine's blower housing as you can without allowing the thermometer to touch any material surface.
2. Place another thermometer outside of the building or compartment in the open air (Keep the thermometer out of direct sunlight or any other heat sources).
3. Run the engine under maximum load for an extended period of time (at least one hour).
4. The temperature difference between the two should not exceed 15 degrees F.

Note that opening any door, window or other opening can upset the air-flow pattern and result in a significant reduction in the cooling air-flow across the generator set. This may result in overheating, fire, or explosion.

Hot Exhaust Gasses

WARNING: Exhaust fumes/gases are extremely dangerous and can cause severe illness or death. Never breath exhaust fumes produced by a running engine. Only run the engine outdoors where ventilation is plentiful. Exhaust gases contain carbon monoxide, a colorless, odorless and extremely dangerous gas that can cause unconsciousness or death. Symptoms of carbon monoxide poisoning include: dizziness, nausea, headaches, sleepiness, vomiting or incoherence. If you or anyone else experiences these symptoms, get out into fresh air immediately. Stop the engine and do not restart the engine until it has been inspected and if necessary repaired or reinstalled in a well ventilated area.

WARNING: Hot exhaust gasses must never be directed toward anything that may catch fire or explode.

It is extremely important to discharge engine exhaust gasses away from the engine and out of the building. If these gasses remain in the cylinder, poor performance or eventual engine damage may result. This condition results from excessive back-pressure, which could be caused by any one or a combination of the following conditions:

1. Exhaust pipe too long or the diameter is too small.
2. Excessive number of sharp bends in the exhaust system.
3. Obstruction in the exhaust system.
   Backpressure must not exceed 20” of water column.

The direction of the discharged hot air and hot exhaust gases is important as they have the potential to create brown spots on the lawn or adjacent structures. In extreme cases this extremely hot air could cause dried grass or other debris to ignite.

Exhaust lines should be as short and straight as possible. Long pipe lengths and elbows tend to resist the flow of gases and accumulate carbon deposits. Each pipe fitting and elbow will further restrict the exhaust flow.

Guidelines for Exhaust System

1. If you are using a remote muffler it should be mounted as close to the engine as possible, since it will clog with carbon if it’s operating temperature is too low.
2. If you are using a remote muffler a flexible coupling of 12” or more must be installed between the exhaust line and the manifold to absorb the engine’s vibration. However, a short, solid section of pipe between 6” and 8” long should be placed between the connection of the manifold and the flexible coupling. This nipple will reduce the possibility of the hot gases burning up the flexible coupling.
3. It is extremely important that you do not allow the hot exhaust gases to re-circulate into the engine’s cooling air intake.
4. Water is one by-product of combustion and is present in the exhaust pipes or muffler. This water must be kept from draining back into the engine. This can be done by slanting the horizontal section of the exhaust system piping downward slightly, away from the engine. A water trap consisting of a tee extension with a drain cock should also be provided. This water trap should be located between the flex coupling and the muffler, but as close to the engine as possible on a horizontal section of the exhaust piping.
5. It is also recommended that an exhaust rain cap be used whenever it is possible that rain could get into the system. This will help to prevent corrosion and damage to the exhaust system and engine.
6. The exhaust system is subject to the engine’s vibration and it must therefore be solidly secured to reduce mechanical stress and the potential for breakage.
7. The engine’s exhaust system is the hottest component of the installation and extreme care and considerations must be given to it.

8. As much of the exhaust piping as possible should be located near the power ventilation exhaust. This will reduce the radiant exhaust heat inside the building.
9. Keep all fuel and its associated piping away from all components of the engine exhaust system.
10. After the exhaust system is installed it should be inspected on a regular basis to assure there are no toxic exhaust gas leaks. In some areas this inspection may be provided by your local public service.
11. A carbon monoxide tester may be installed to detect the presence of the deadly gas during times when you are in the building with the engine running (during testing or maintenance).

WARNING: Never allow the exhaust outlet to be positioned so that the exhaust gases are directed towards any openings or air entry routes (doors, windows, vents, etc...) of an occupied building. When discharging the hot exhaust gases out of the building do not direct them towards anything that could catch fire or explode.

WARNING: Exhaust fumes/gases are extremely dangerous and can cause severe illness or death. Never breath exhaust fumes produced by a running engine. Only run the engine outdoors where ventilation is plentiful. Exhaust gases contain carbon monoxide, a colorless, odorless and extremely dangerous gas that can cause unconsciousness or death. Symptoms of carbon monoxide poisoning include: dizziness, nausea, headaches, sleepiness, vomiting or incoherence. If you or anyone else experiences these symptoms, get out into fresh air immediately. Stop the engine and do not restart the engine until it has been inspected and if necessary repaired or reinstalled in a well ventilated area.

Installation

The generator is completely assembled, tested and adjusted at the factory before it is shipped to you. The procedures presented in this manual are suggestions and it is the responsibility of the Owner/Operator to arrange for these procedures to be performed by licensed contractors according to all applicable codes including local codes for your Municipality/City/County and State. External connections required at the time of installation are:

1. Fuel System.
2. Electrical Connections - power wiring (optional transfer switch) and control wiring.
3. Battery (not included).
4. Ground Connection.

After installation, the post installation checks must be performed prior to starting the engine.

After these checks have been performed and the system operation is verified to be good, refer to Section 5 Maintenance for periodic checks that must be performed at scheduled intervals to ensure continued operation with minimal problems.

Fuel Connections

Fuel selection is Natural Gas or LPV (Liquid Propane Vapor). If natural gas supply is used, follow the “Natural Gas Connections” procedure. If LPV supply is used, follow the “LP Vapor Connections” procedure. Table 3-4 defines the flow rate required for each fuel type.

Table 3-4 Fuel Consumption Natural and LPV

Model	Fuel Consumption at 100% load cubic ft/Hr (cubic m/Hr)		Model	Fuel Consumption at 100% load cubic ft/Hr (cubic m/Hr)	
	Natural Gas	LP Vapor		Natural Gas	LP Vapor
GLC10	348(9.9)	145.2(4.1)	GLC45	584(16.5)	242(6.9)
GLC15	438(12.4)	189.3(5.4)	GLC50	731(20.7)	269(8.2)
GLC20	528(15.0)	233.4(6.6	GLC60	780(22.1)	321(9.1)
GLC25	618(17.5)	277.5(7.9)	GLC80	1012(28.7)	425(12)
GLC30	526(14.9)	197(5.6)	GLC100	1133(32.1)	487(13.8)
GLC35	575(16.3)	240(6.0)	GLC125	1651(46.8)	852(16.5)

General Considerations

1. A generator set needs the engine to deliver 2 hp of energy to the alternator for every 1000 watts of electric output power (example: an 8000 watt generator needs the engine to deliver 16 hp of energy to the generator end).
2. An engine needs 10,000 BTU’s of fuel energy per horsepower of engine power to provide a sufficient supply of fuel (example: a 16 Hp engine needs 160,000 BTU’s of fuel energy for it to work properly). This fuel must be supplied to the regulator on the generator set at a pressure of 6 oz (11 inches of water column). To achieve this 6 oz. pressure in a L.P. System, you will normally have to reduce the tank pressure by means of a primary regulator or a regulator system of 2 or more regulators.
3. There are 2,516 BTU’s in one cubic foot of Propane (LP Fuel).
   There are 1,096 BTU’s in one cubic foot of Natural Gas.
4. There are 36.39 cubic feet in one gallon of Propane.
   There are 57.75 cubic feet in one gallon of Natural Gas.
5. There are 8.58 cubic feet per pound of Propane.
   There are 23.56 cubic feet per pound of Natural Gas.
6. When installing the piping for the gaseous fuel supply please refer to the pipe chart in Tables 3-5 and 3-6 to be sure you are using piping of significantly large size to deliver the necessary amount of fuel.
7. If copper tubing is used, it should be “K” or “L” having a minimum wall thickness of 0.032 inches. Black Iron Pipe is recommended but follow building codes for your area.

The following pamphlets are available from:

National Fire Protection Association (NFPA) P.O. Box 9101 Quincy, MA 02269

No. 37 - Combustion Engines
No. 54 - Gaseous Appliances and piping
No. 58 - Storage and handling LPV

Example: Determining Pipe Size for Natural Gas

A generator has a 16Hp engine 60 feet from the supply.
Determine the supply pipe size for Natural Gas fuel.
16 x 10,000 = 160,000 BTU's / per hour for proper operation.

$$\frac{160,000}{1,096} = \text{ 146 cubic feet per hour.}$$

From Table 3-6, a 60 foot run requires a minimum 1" pipe at full engine load.

Natural Gas Connections

The incoming pressure must be 11 inches water column (6 oz. pressure).

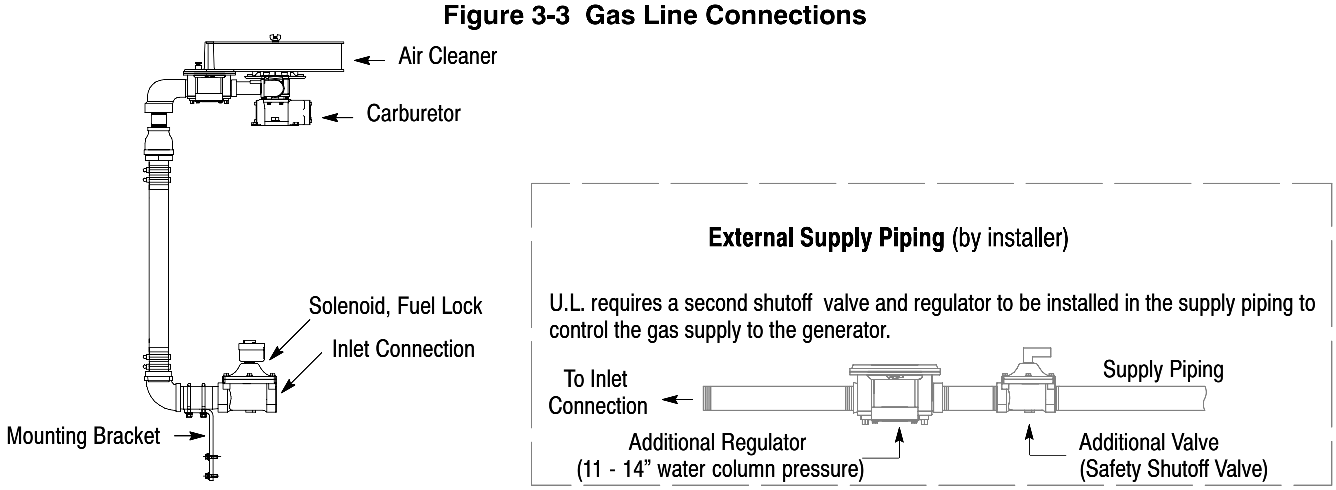
Table 3-5 Natural Gas Flow Rate (Cubic Feet per Hour) per Pipe Length

Pipe Length (Feet)	**Iron Pipe Size**										
	1/2″	3/4″	1″	1- 1/4″	1- 1/2″	2″	2- 1/2″	3″	4″	6″	8″
15	73	165	332	722	1174	2386	3704	6253	13352	37229	
30	50	115	232	515	818	1712	2646	4521	9331	26330	53728
45	41	95	191	418	673	1419	2213	3752	7600	22462	43867
60	37	83	166	366	587	1241	1924	3319	6542	18595	37999
75		74	149	332	524	1077	1684	2886	5772	16652	33959
90		67	137	298	433	962	1501	2597	5291	15200	31025
105		63	126	274		885	1376	2357	4906	14064	28715
120			115	260	404	827	1289	2213	4618	13160	26859
150			105	233	366	750	1174	2011	4185	11775	24050
180			96	216	337	693	1077	1876	3848	10736	21934
210			89	197	308	635	991	1712	3559	9937	20298
240				183	289	596	933	1616	3357	9235	18990
270				171	274	558	875	1520	3127	8658	17903
300				164	260	524	827	1433	2886	8177	16998

Note: Almost all operation problems are related to the installation techniques used. Do Not guess, be sure pipe size is adequate for required flow rate.

1. Connect the proper size gas pipe at the Inlet Connection to the Fuel Lock Solenoid. Connect the Natural Gas pipe line shown in Figure 3-3 using the correct size pipe for the required flow rate and length of pipe. Refer to Table 3-5 for pipe size. Be certain that all connections are sealed and no leaks are present. The installer must ensure that all gas connections comply with all building codes.
2. Verify Fuel Supply Pressure
   Prior to initial operation of generator, verify that fuel system pressure is 11″ Water Column (6 oz. pressure) and fuel pipe sizes comply with Table 3-5.
3. Proceed to Electrical Connections.

Figure 3-3 Gas Line Connections



Example: Determining Pipe Size for LPV

A generator has a 16Hp engine 60 feet from the supply.
Determine the supply pipe size for Natural Gas fuel.
16 x 10,000 = 160,000 BTU's / per hour for proper operation.

$$\frac{160,000}{2,516} = 63.5 \text{ cubic feet per hour.}$$

From Table 3-6, a 60 foot run requires a minimum 1" pipe at full engine load.

LP Vapor Connections (vapor withdrawal only)

The LPV connections should only be made if your generator is setup to run on LPV. If it is setup to run on Natural Gas, contact your Baldor representative and do not continue with installation.

The incoming pressure must be 11 inches water column (6 oz. pressure).

Table 3-6 LP Vapor Flow Rate (Cubic Feet per Hour) per Pipe Length

Pipe Length (Feet)	**Iron Pipe Size**										
	1/2″	3/4″	1″	1- 1/4″	1- 1/2″	2″	2- 1/2″	3″	4″	6″	8″
15	48	109	218	475	772	1570	2437	4115	8786	24497	50007
30	33	76	153	339	538	1127	1741	2975	6140	17325	35353
45	27	63	126	275	443	934	1456	2469	5001	14781	28865
60	24	54	110	241	386	817	1266	2184	4304	12236	25004
75		49	98	218	345	709	1108	1899	3798	10957	22345
90		44	89	196	310	633	987	1709	3482	10001	20414
105		41	83	180	285	582	905	1551	3228	9254	18895
120			76	171	266	544	848	1456	3038	8659	17673
150			69	153	241	494	772	1323	2754	7748	15825
180			63	142	222	456	709	1234	2532	7064	14432
210			58	130	202	418	652	1127	2342	6439	13356
240				120	190	393	614	1063	2209	6077	12405
270				113	180	367	576	1000	2057	5697	11780
300				108	171	345	544	943	1899	5381	11179

Note: Almost all operation problems are related to the installation techniques used. Do Not guess, be sure pipe size is adequate for required flow rate.

1. Connect the proper size gas pipe at the input to the LP Vapor regulator. Connect the LPV pipe line shown in Figure 3-3 using the correct size pipe for the required flow rate and length of pipe. Refer to Table 3-6 for pipe size. Be certain that all connections are sealed and no leaks are present. The installer must ensure that all gas connections comply with all building codes.
2. Verify Fuel Supply Pressure
   Prior to initial operation of generator, verify that fuel system pressure is 11″ Water Column (6 oz. pressure) and fuel pipe sizes comply with Table 3-6.
3. Proceed to Electrical Connections.

Electrical Connections Class 1 wiring methods must be used for field wiring connections to terminals of a class 2 circuit. It is the responsibility of the owner/operator to arrange for these procedures to be performed by a licensed electrical contractor and ensure conformance to all applicable codes including local codes peculiar to your municipality/city/county and state. Wire size and insulation type should be as required by NEC (National Electrical Code) and local codes.

Warning: Never connect this generator to the electrical system of any building unless a licensed electrician has installed an approved transfer switch. The national electrical code (NEC) requires that connection of a generator to any electrical circuit normally powered by means of an electric utility must be connected by means of approved transfer switch equipment to isolate the electrical circuit from the utility distribution system when the generator is operating. Failure to isolate the electrical circuits by such means may result in injury or death to utility power workers due to backfeed of electrical energy onto the utility lines.

Warning: Incorrect installation of this generator set could result in property damage, injury or death. Connection of the generator to its fuel source must be done by a qualified professional technician or contractor.

WARNING: Be sure the system is properly grounded before applying power. Do not apply AC power before you ensure that grounds are connected. Electrical shock can cause serious or fatal injury. NEC requires that the frame and exposed conductive surfaces (metal parts) be connected to an approved earth ground. Local codes may also require proper grounding of generator systems.

Intended Use The intended purpose of this generator set is to provide emergency power when the main utility power supply is interrupted. Therefore, it is important that all the wiring that connects the generator set with your house, transfer switch, distribution box, battery charger, etc. be properly installed.

Circuit Protection Circuit protection is not provided within the generator. Circuit Breaker protection is an option. If purchased with your generator, the breaker box is mounted to the generator prior to shipment. If the optional circuit breaker protection was not ordered, see “GLC Circuit Breaker & Wire Size Data” in Appendix A for recommendations.

Wire Size Proper lead wire from the circuit breaker to the automatic transfer switch (or load switching device) is mandatory. See transfer switch information for connection information. When connecting the generator output to an electrical load, a UL listed circuit breaker with the appropriate ratings must be provided within 25 feet of the generator set. Use only copper wires.

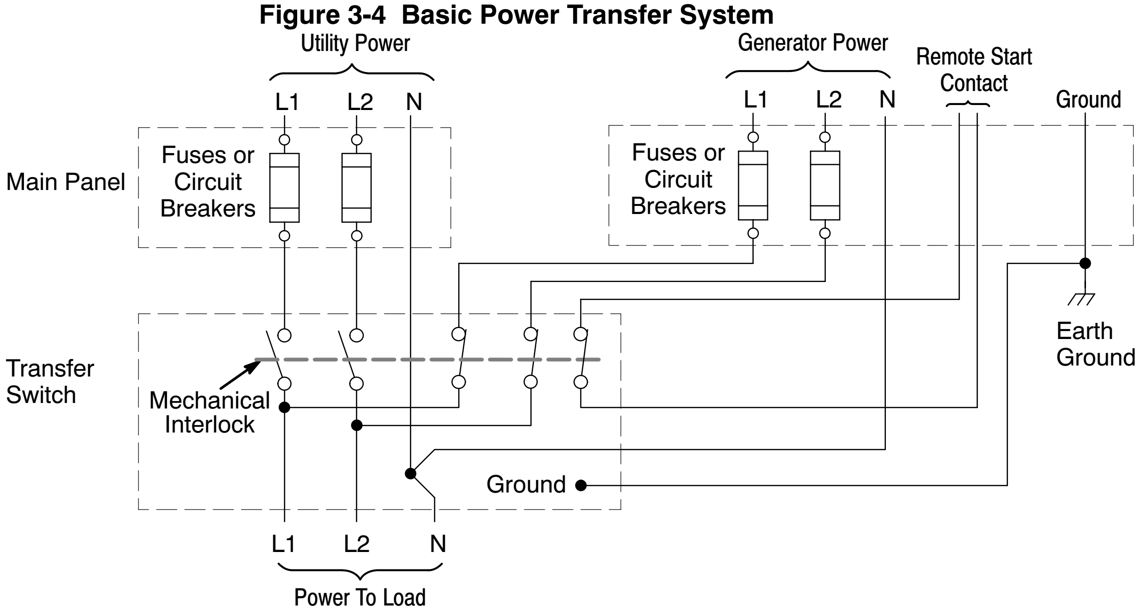
Generator Rating		**Input Breaker Rating (at 115% FLA)**				
Catalog No.	**Kilowatt (kW) Rating**	**1 Phase Amps (240VAC) ***	**3 Phase Amps (240VAC) ***		**3 Phase Amps (480VAC) ***	
		LPV/Nat. Gas Delta (Wye)	Nat. Gas Delta (Wye)	LPV Delta (Wye)	Nat. Gas Delta (Wye)	LPV Delta (Wye)
GLC10	10	50				
GLC15	15	70				
GLC20	20	100				
GLC25	25	125				
GLC30	30	110	110	110	60	60
GLC35	35	125	125	125	60	60
GLC45	45	150	150	175	70	80
GLC50	50	175	175	175	90	90
GLC60	60	200	200	200(225)	100	110
GLC80	80	300	300	300	150	150
GLC100	100	300	300	350	150	175
GLC125	125	450	450	400	225	200

Transfer Switch Considerations

The following are general considerations for the safe use of a transfer switch:

1. The transfer switch should be located inside the building near the main breaker box or the disconnect box.
2. The transfer switch must be kept away from any location that might allow water to get on it.
3. If the transfer switch is mounted outside, it must be protected from the environment and it's elements.
4. Do not mount the transfer switch on the generator set.
5. Do not mount the transfer switch where flammable liquids or vapors are present.

Figure 3-4 Basic Power Transfer System



Remote Start

Connect the remote start start contact (from transfer switch) to GLC Remote Start terminals.

Single Phase Power Connections

Output power connections must be fused within 25 feet of the generator. If the wires to the transfer switch are shorter than 25 feet, connect L1, L2 and N to the transfer switch being sure to follow NEC and local codes. If the wires to the transfer switch are longer than 25 feet, UL requires that branch circuit protection be provided.

Power connections are made at L1, L2, Neutral and Ground points indicated in the Customer Connections area shown in Figure 3-5.

Figure 3-5 Single Phase Connections

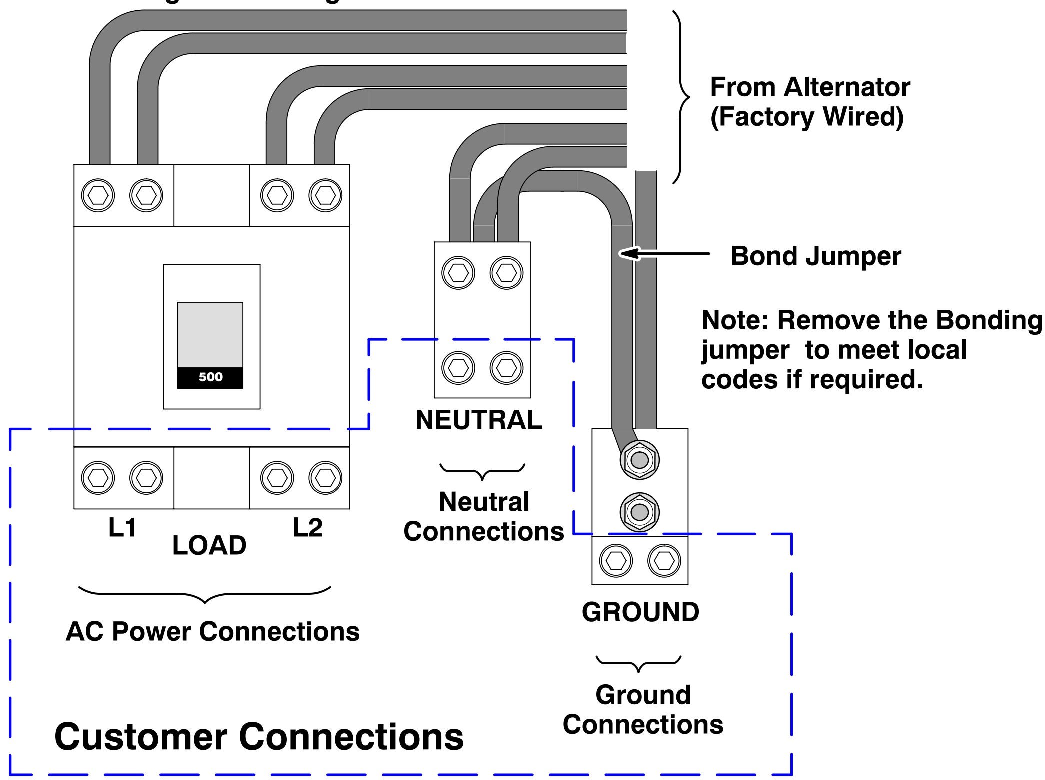
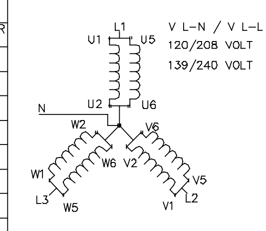


Figure 3-6 Three Phase WYE and DELTA Connections

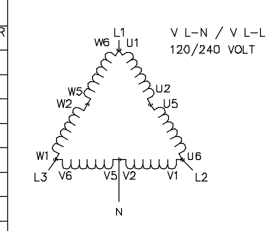
Parallel WYE

Term Block	Gen Lead	REGULATOR Lead
A	NO LEAD	
B	NO LEAD	
C	NO LEAD	
	W2, W6, V2	
N	V6, U6, U2	
L3	W1, W5	(7030)
L2	V1, V5	3
L1	U1, U5	2



Series Delta

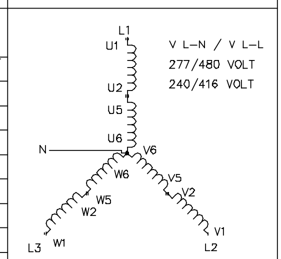
Term Block	Gen Lead	REGULATOR Lead
L1	W6, U1	
L2	U6, V1	2
L3	W1, V6	3 (7030)
D	W2, W5	
E	U2, U5	
	V5, V2	
G	NO LEAD	
H	NO LEAD	



N Series WYE

Term Block	Gen Lead	F2 PINOUT Lead
L1	U1	
L2	V1	
L3	W1	
	U6, V6, W6	
E	U2, U5	2
F	V2, V5	3
G	W2, W5	(7030)
H		

N



Battery Charger Considerations

1. Mount the battery charger on the generator or as close to the generator as possible.
2. If you mount the battery charger inside the building, mount it near the main breaker box or disconnect box.
3. If you mount the battery charger outside, you must protect it from the environment and the elements.
4. Do not mount the battery charger where flammable liquids or vapors are present.

General Wiring Considerations

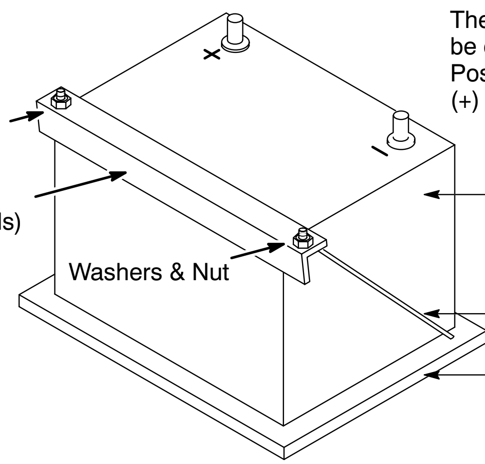
1. When routing the interface wiring, do not route it up against anything that could cut or chafe the wiring. do not route the wire up against any hot or potentially hot object.
2. Make sure that all the electrical components (generator set, transfer switch, battery charger, etc.) share a common hard wired ground.
3. Check with your local building inspector to determine what you must do to comply with the local regulations for grounding of this type of permanent installation.

Battery Connections The generator may be shipped with no battery installed.

Procedure: The correct type battery must be installed in the battery compartment provided, see Table 3-7. Installation and servicing of batteries is to be performed or supervised by personnel knowledgeable of batteries and the required precautions.
Keep unauthorized personnel away from batteries.

1. Open access doors and locate battery tray.
2. Place the correct battery (see Table 3-7) on the tray.
3. Install the Battery Hold Down Bar and Rods as shown in Figure 3-7.
    a. Place the bent end of the Battery Hold Down Rod through the hole in the Battery Tray.
    b. Place the threaded end of the Battery Hold Down Rod through the hole in the Battery Hold Down Bar and secure with flat washer, lock washer and nut.
    c. Repeat steps a and b for the other Battery Hold Down Rod.

Figure 3-7 Battery Installation



4. Connect the positive lead to the positive (+) battery terminal.
5. Connect the negative lead to the negative (-) battery terminal.
6. Do not lay tools or metal parts on top of batteries.
7. Connect charging source to the battery terminals.
8. Disconnect the battery's ground terminal before working in the vicinity of the battery or battery wires. Contact with the battery can result in electrical shock when a tool accidently touches the positive battery terminal or wire. The risk of such shock is reduced when the ground lead is removed during installation and maintenance.

Recommended Engine Oil and Battery Type

When replacing batteries, use only the recommended battery for your generator, see Table 3-7.

Table 3-7

MODEL	SUMMER OIL	WINTER OIL	OIL CAPACITY	RECOMMENDED BATTERY	(AMPS) COLD CRANKING
GLC10-25	SAE. 30	5W/30	5.0 QTS	BCI Group 31	675
GLC30	SAE. 30	5W/30	6.0 QTS	BCI Group 31	925
GLC35	SAE. 30	5W/30	6.0 QTS	BCI Group 31	925
GLC45	SAE. 30	5W/30	6.0 QTS	BCI Group 31	925
GLC50	SAE. 30	5W/30	6.2 QTS	BCI Group 31	925
GLC60	SAE. 30	5W/30	6.2 QTS	BCI Group 31	925
GLC80	SAE. 30	5W/30	6.5 QTS	BCI Group 31	925
GLC100	SAE. 30	5W/30	6.5 QTS	BCI Group 31	925
GLC125	SAE. 30	5W/30	6.5 QTS	BCI Group 31	925

Post Installation Checks

When the initial installation is complete, these checks must be performed before starting the engine. These checks are not required before each start, only after the initial installation.

1. Generators that have been in transit or storage for long periods may be subjected to extreme temperature and moisture changes. This can cause excessive condensation, and the generator windings should be thoroughly dried before bringing the generator up to full nameplate voltage. If this precaution is not taken, serious damage to the generator can result.

Caution: Do not apply high voltage to windings (do not start the generator) in a moisture-saturated condition. Moisture can cause insulation breakdown, making it necessary to return the generator for repair.

Note: These precautions are especially necessary in locations such as seaboard installations and other high humidity areas. Some installations will be in atmospheres that are much more corrosive than others.

2. Verify that the transfer switch is in Utility Power mode. No power must be present at the generator or transfer switch connections. Verify with a voltmeter.
3. Verify that the engine starting battery is disconnected so accidental starting is not possible.
4. Verify that the generator is securely mounted and anchored to its cement pad.
5. Verify that proper clearance exists on all sides and top of enclosure.
6. Verify that generator power is properly connected to the transfer switch.
7. Verify that generator and transfer switch are properly grounded.
8. Assure that generator is a safe distance from any flammable or combustible material.
9. Verify that the generator and transfer switch load are voltage compatible.
10. Verify that no load is connected to the circuit breaker and/or transfer switch.
11. Inspect the engine and generator and verify that there are no loose wires or components. Tighten if necessary.
12. Verify that the ground conductor is of correct wire size and properly connected.
13. Verify engine oil level is full. Refer to engine manual if necessary.
14. Verify engine coolant level is full. Refer to engine manual if necessary.
15. Verify exhaust system to assure it is in properly connected and pointing away from combustible materials.
16. Verify that the Master Control Switch is still in the “Stop” position.
    Connect the engine starting battery to the starter. Verify it is installed correctly.
17. Verify the fuel source is ON and the pressure and flow rate are correct.
18. Remove all tools, rags, etc. from inside the generator enclosure. Close all enclosure doors and be sure no hands are inside the generator enclosure when it starts.
19. Verify all loads are disconnected.
20. Start the generator. (Refer to Section 4 Operation for details).
21. The engine should begin to crank and start when the fuel moves through the pipe to the carburetor. If the engine fails to start, refer to Section 5 Troubleshooting.

Post Installation Checks Continued

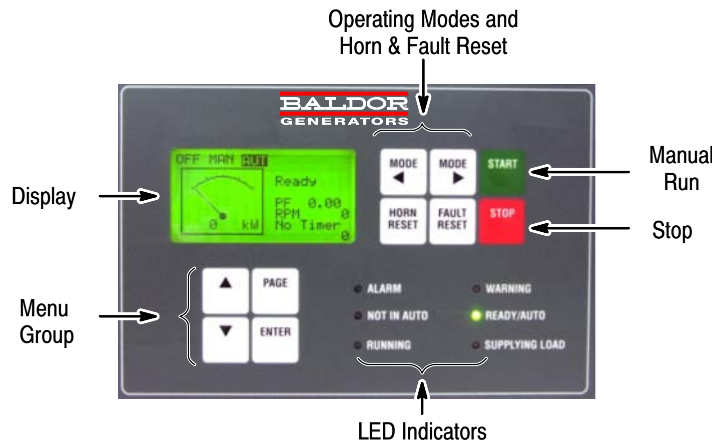
22. With the engine running, several checks must be made:
    a. Verify there are no fuel leaks. If a fuel leak is detected, stop the engine immediately (move the Master Control Switch to the “Stop” position) and repair the leak before proceeding.
    b. Verify there are no coolant or oil leaks. If a leak is detected, stop the engine immediately and repair the leak before proceeding.
    c. Verify that operation is smooth. If belt squeals, vibrations or other sources of noise exist, stop the engine immediately and repair before proceeding.
    d. Verify that the correct voltage exists (line-to-line and line-to-neutral) at the generator and at the transfer switch.
    e. Minor adjustment of the output voltage is made using the “Voltage Adjust” potentiometer on the control panel.

WARNING: Engine coolant is under pressure and is near the boiling point of water when engine is hot. Do not open the coolant system until the engine has completely cooled. Hot coolant can cause severe burns and other injuries. When engine is cool, coolant level can be checked.

23. After the operation checks are made, stop the engine (move the Master Control Switch to the “Stop” position) and wait at least 2 hours for the engine to cool. When the engine is cool, check engine oil and coolant levels as instructed in the engine operation manual.
24. Close all enclosure covers. The post installation checks are now complete.

Digital Engine Controller Description EM0046A21 (MRS17)

Figure 4-8 Operator Control Panel



Note: The operator control panel is equyipped with a heater element that allows the LCD display to operate to -40°C (not the entire generator set, see generator specifications). This heater operates from the main battery power.

LED Indicators
Alarm (red) - Alarm (shutdown) condition occurred. Annunciates & shuts down generator.
Not In Auto (red) - Control is not in auto mode and cannot provide standby power.
Running (green) - Generator is running, no alarms or warnings.
Warning (yellow) - A warning condition has occurred. Annunciates only.
Ready/Auto (green) - Control is in Auto mode and ready to provide standby power.
Supplying Load (green) - Generator is providing output voltage to load.

Table 4-8 Alarm & Warning Conditions

Alarm	Warning	
X	X	High Coolant temperature
X	X	Low Oil pressure
X	X	Low Fuel level
X	X	Generator Under/Over Voltage
X	X	Generator Under/Over Frequency
X	X	Generator Over Current
X		Generator Overspeed
	X	Coolant temperature Low
	X	Starting battery Under/Over Voltage

Manual Run Immediately begins the crank cycle to start engine and produce power (MAN mode only).
Start Start generator set operation (MAN mode only).
Stop Stops the Engine and generator set (MAN mode only).
Display Displays setpoints, adjustments, Alarms and Warning conditions and Operating Mode selections.
Page Changes menu displayed - Measurement, Adjustment or History.
Mode ◀ and ▶ Allows selection of OFF - MAN - AUTO mode choices.
Horn Reset Deactivates the Horn output.
Fault Reset Reset Alarms and Warnings.
▲ and ▼ Selects the menu choice, select the setpoint or select the menu or increase/decrease the setpoint value.
Enter Confirm and accept changed setpoint value.
Enter + ▲ and ▼ Adjusts display contrast.
Enter+ Fault Reset Clears engine ECU faults.

Digital Engine Controller Description EM0046A21 (MRS17) Continued

Operating Mode Press Mode ◀ or ▶ to scroll though the list of operating modes: Off, Manual and Automatic. The control mode is shown in the highlighted area at the top of the display, Figure 4-9.

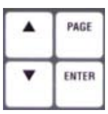
When the desired Control Mode is highlighted, press Start to begin operation. Press Stop to terminate operation.

OFF - Generator set operation is not allowed.

MAN - Press Start to manually start the generator set immediately. Press Stop to stop the generator set immediately.

AUT - Start and Stop buttons are ignored. The binary input terminal conditions start and stop the generator set.

Display Menus Three display menus are available: Measurement, Adjustment and history. Press the Page button repeatedly to display each menu. Use ▲ ▼ and Enter keys to change and accept setpoint values or press the Page button to cancel changes.



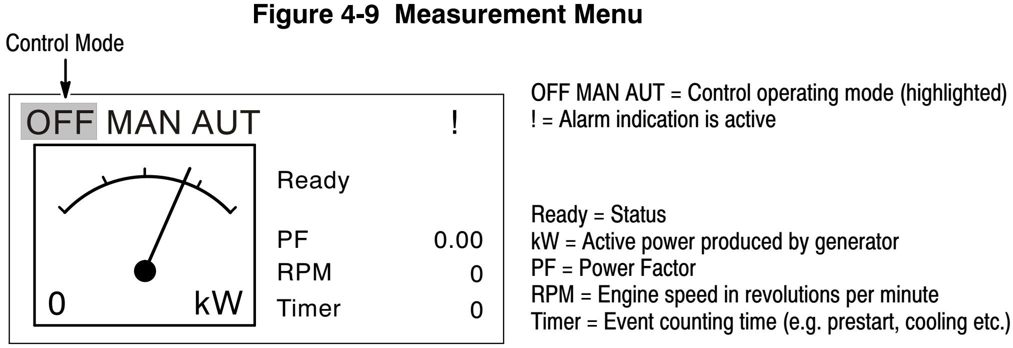
Measurement Menu

The measurement menu, shown in Figure 4-9 displays the operating mode, and operating parameters such as kW, engine RPM etc.

Figure 4-9 Measurement Menu

Operating Modes and Horn & Fault Reset





OFF Mode

Starting of the generator set is not possible. Outputs STARTER (BO1) and FUEL SOLENOID (BO2) are not energized. No action if buttons START and STOP are pressed.

MAN Mode

START button starts the generator set.

STOP stops the generator set.

This operation is further defined in Table 4-9.

AUT Mode

No action if buttons START and STOP are pressed.

Engine Start/Stop request is given by binary input REM Start/Stop (BI1).

Table 4-9 Manual Mode Sequence Description

Menu	Status	Condition of Transition	Action [1]	Next State
Main Measurement	Ready	Start request	PRESTART on, Prestart time counter started	PRESTART
		RPM > 2 or Oil pressure detected or Gen voltage > 10V		Stop (Stop fail)
		OFF mode selected or Shut down alarm active		Not Ready
	Not Ready	RPM < 2, Oil pressure not detected, Vgen < 10V, no shutdown alarm active, other than OFF mode selected		Ready
	Prestart	Prestart time elapsed	STARTER on, FUEL SOLENOID on, MaxCrank time counter started	Cranking
	Cranking	RPM> Start RPM	STARTER off, PRESTART off	Starting
		D+ input activated or oil pressure detected or Gen voltage > 25% Vgnom	STARTER off, PRESTART off	Cranking
		MaxCrank time elapsed, 1st attempt	STARTER off, FUEL SOLENOID off, STOP SOLENOID on, CrankFail pause timer started	Crank pause
		MaxCrank time elapsed, last attempt	STARTER off, PRESTART off	Shutdown (Start fail)
	Crank Pause	CrankFail pause elapsed	STARTER on, FUEL SOLENOID on, STOP SOLENOID off, MaxCrank time counter started	Cranking
	Starting	30% Nominal speed reached	READY TO LOAD on, MaxStabTime counter started	Running
	Running	Stop request	READY TO LOAD off, Cooling time timer started	Cooling
		RPM = 0 or any other shutdown condition	READY TO LOAD off, FUEL SOLENOID off	Shutdown
	Loaded	RPM = 0 or any other shutdown condition	FUEL SOLENOID off, STOP SOLENOID on, READY TO LOAD off	Shutdown
	Cooling	Cooling time elapsed	FUEL SOLENOID off, STOP SOLENOID on	Stop
		RPM = 0 or any other shutdown condition	FUEL SOLENOID off, STOP SOLENOID on	Shutdown
		Start request	READY TO LOAD on	Running
	Stop	RPM = 0, Oil pressure not detected, Vgen < 10V		Ready
		60 sec. Elapsed		Stop (Stop fail)

[1] Some output conditions are optional and may require additional programming of field connection. See appropriate wiring diagram.

Adjustment Menu

The adjustment menu, Figure 4-10 allows setting engine and generator values such as Passwords, Pre-Start Time, Crank Time, Cool Down Time, Alarm Conditions and values, Shutdown Conditions and values, power transfer settings, etc.

Figure 4-10 Adjustment Menu

```
> ENGINE BASIC
  ENGINE PROT
  GEN BASIC
  GEN PROTECT
```

Use ▲ and ▼ to move the cursor to the desired parameter.
Press ENTER to select the parameter group.
Press PAGE to move to the next page of menu items.

Alarm List

Shows the active alarms and warnings. Press fault reset to clear the list.

ECU Alarm List

Shows the active ECU (engine control unit) fault codes. Press ENTER + fault reset to clear the list.

Alarms

Following alarms are available:

Sensor fail (FLS) see Table 4-10

Sensor fail is detected when measured value is 6% out of selected sensor characteristic. Sensor fail is indicated by ##### symbol instead measured value.

Warning (WRN) see Table 4-10

When warning comes up, only alarm outputs and common warning output are closed.

Shut down (SD) see Table 4-10

When the shut-down alarm comes up, InteliLite opens outputs GCB CLOSE/OPEN, FUEL SOLENOID, STARTER and PRESTART to stop the engine immediately. Alarm outputs and common shutdown output are closed. Active or not reset protection disables start.

Table 4-10 Possible Warnings

Events specification	Protection type
Wrn Oil press	WRN
Sd Oil press	SD
Wrn Water temp	WRN
Sd Water temp	SD
Wrn Wtemp Low	WRN
Wrn Fuel Level	WRN
Sd Fuel Level	SD
Battery voltage <, >	WRN
Battery flat	SD
Start fail	SD
Vgen <, >	SD
Vgen unbl	SD
Fgen <, >	SD
Igen unbl	SD
Overload	SD
RPM over	SD
RPM under	SD
PickupFault	SD
Stop fail	SD
WrnServiceTime	WRN
Emergency Stop	SD
ECU Common Warning	WRN
ECU Shutdown	SD

Inputs and Outputs

Any Binary input or output can be configured to any controller terminal Inputs are BI1 - BI6, Outputs are BO1 - BO6) or changed to different function by LiteEdit software.
There is fixed 1 sec delay when any binary input is configured as protection.

Table 4-11 Binary Inputs

Alarm	Alarm type Warning or Shut down Alarm active All the time, or Engine running only
Rem start/stop	External request for engine run. AUT mode only.
Emergency stop	If the input is opened, shut down is immediately activated. Input is inverted (normally closed).
Rem start/stop	External request for engine run. AUT mode only.

Table 4-12 Binary outputs

Starter (relay output)	The closed relay energizes the starter motor. The relay opens if: • The firing speed is reached or • Maximum time of cranking is exceeded or • Request to stop occurs
Fuel solenoid (relay output)	Closed output opens the fuel solenoid and enables the engine start. The output opens if: Emergency stop occurs or Cooled gen-set is stopped or In pause between repeated starts
Prestart	Output is closed prior to the engine start (Prestart) and opens when START RPM speed is reached. During repeated crank attempts the output is closed too. The output could be used for pre-glow, pre-heat or prelubrication.
Common Sd	Output closes when any shut-down alarm appears. The output opens, if alarm is not active and FAULT RESET is pressed. Used for shunt trip.

Analog Inputs

Three analog inputs for resistive sensor 0 to 2400 ohms measuring are available on IL controller. Use LiteEdit software to modify configuration.
The Analog inputs values assignment (AI1 = Oil press, AI2 = Water temp, AI3 = Fuel level) is fix.
It is possible to configure on each Analog input:

- Reading from IL Analog inputs or from Engine Control Unit via CAN bus (J1939)
- Sensor characteristics - from the list,
- Value dimension (e.g. psi - bars, °F - °C, % - l)
- Number of decimal points (0, 1, 2, ...).

Note: Corresponding Analog input terminal is dead when reading is switched to ECU. All values from ECU shall show ####, but no alarm is displayed when CAN communication is interrupted.

Warning and shut-down limits are adjusted in Engine protection group.

Table 4-13 Analog Inputs

AI1 Oil press	Oil pressure analog input. Default VDO sensor in range 0 to 145 psi.
AI2 Water temp	Water temperature analog input. Default VDO sensor in range 32 to 212°F
AI3 Fuel level	Fuel level analog input. Default VDO sensor 0-180R = 0-100%.

Set points

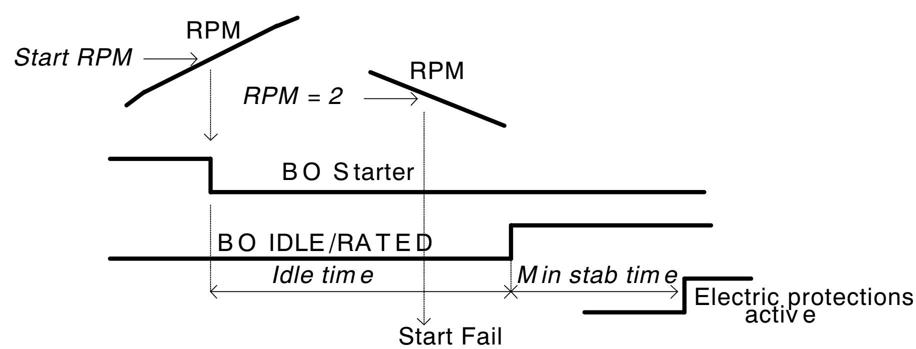
Table 4-14 Basic Setpoints

EnterPassword	Password is a four-digit number. Password enables change of relevant protected set points Use ⇑ or ⇓ keys to set and ENTER key to enter the password.
ChangePassword	Use ⇑ or ⇓ keys to set and ENTER key to change the password.
Gen-set name	User defined name, used for InteliLite identification at remote phone or mobile connection. Gen-set name is max 14 characters long and have to be entered using LiteEdit software.
Nomin power(3ph)	Nominal power of the generator in three phases connection. Step: 1 kW; Range: 1 - 3000 kW
Nomin power(1ph)	Nominal power of the generator in single-phase connection. Step: 1 kW; Range: 1 - 3000 kW
CT Ratio	Gen-set phases current transformers ratio. Step: 1 A; Range: 1 - 5000 A / 5A
PT ratio	Gen-set potential transformers ratio. Step: 0,1 V / V; Range: 0,1 - 500,0 V / V
Nominal freq	Nominal generator frequency (usually 50 or 60 Hz) Step: 1Hz; Range: 45 - 65 Hz
Gear teeth	Number of teeth on the engine gear for the pick-up. Set to zero, if no pick-up is used. Engine speed is counted from the generator frequency. Step: 1; Range: 0 - 500 Note: Generator frequency can be used only when generator voltage (min 5V) is present before reaching of the firing speed (Starting RPM) after start.
Nominal RPM	Nominal engine speed. Step: 1RPM; Range: 100 - 4000 RPM.
FLTRESGOTOMAN	DISABLED: Controller stays in AUT mode after Fault reset . ENABLED: Automatic switch from AUT (or TEST) to MAN mode after Fault reset to avoid automatic engine start. This function is active for Shut down protection only.
DispBackLightTO	Timeout after which the display backlight is switched off. Step: 1 min Range: 0 - 60 min Default value: 0 = the display lights all the time
Mode IL [OFF, MAN, AUT]	Equivalent to Controller mode changes by MODE▶ or MODE◀ buttons. Note: Controller Mode change can be separately password protected.
RS232 mode [Standard/Modbus]	Communication protocol switch. Standard: LiteEdit communication protocol. Modbus: Modbus protocol. Note: For detail description see chapter Modbus protocol.
Num rings AA	Number of rings prior to open modem connection. Step: 1; Range: 1 - 30 Note: NumberRings AA change is not activated immediately. It is activated after controller is switched on or when modem is connected to controller.

Table 4-15 Engine Setpoints

Start RPM	“Firing” speed when iL controller stops cranking (starter goes OFF). Step: 1% of nominal RPM; Range: 5 - 50 %
Starting POil	When reached controller stops cranking (starter goes OFF). Step: 0,1 psi; Range: -100 - 10000 Note: There are three conditions for stop cranking: Starting RPM, StartingPOil and D+ (when enabled). Starter goes off when any of these conditions is valid.
Prestart time	Time of closing of the PRE-START output prior to the engine start. Set to zero if you want to leave the output PRE-START open. Step: 1s; Range: 0 - 600 s
MaxCrank time	Maximum time limit of cranking. Step: 1s; Range: 1 - 60 s
CrnkFail pause	Pause between crank attempts. Step: 1s; Range: 5 - 60 s
Crank attemps	Max number of crank attempts. Step: 1; Range: 1 - 10
Idle time	Idle time delay starts when RPM exceeds Start RPM . Start fail is detected when during Idle state RPM decreases below 2. During the Idle time timer running the binary output IDLE/NOMINAL is opened, when it elapses the IDLE/NOMINAL output closes. Binary output IDLE/NOMINAL opens during Cooling period again. Step: 1 s; Range: 0 - 600 s Note: If the IDLE function not supported on the governor, set the Idle time nevertheless to minimum 5s to avoid Underspeed possibly caused by instability of the engine short after start.
GCB CloseDelay	GCB can be closed earliest GCB CloseDelay after Stabil time when all electric values are in overunder voltage and over-under frequency limits. Step: 1 s; Range: 0 - 300 s
Stabil time	Generator Nominal voltage is detected during genset start after starter is switched off and Idle time elapses. Electric generator protections are active since detection. Step: 1 s; Range: 0 - 300 s
MinStpValvTime	Binary output Stop solenoid closes when stop sequence begins and closes at least for MinStpValvTime. Example MinStpValvTime = 20 sec. a) When engine stops (RPM=0) in 10 seconds, Binary output Stop solenoid still stays closed for 10 sec. b) When engine stops in 30 seconds, Binary output Stop solenoid opens 10 seconds after RPM=0 and Vg =0 and Oil pressure = 0. Those 10 sec is fix time for safe stop. Step: 1s; Range: 0 - 180 s Note: Stop of engine is detected when all following conditions are met: RPM =0, Oil pressure < StartingPOil and Generator voltage < 10 VAC. Stop fail is detected when is difference between those conditions, e.g RPM=O and Generator voltage > 10V.

Idle Function



Stabil Time

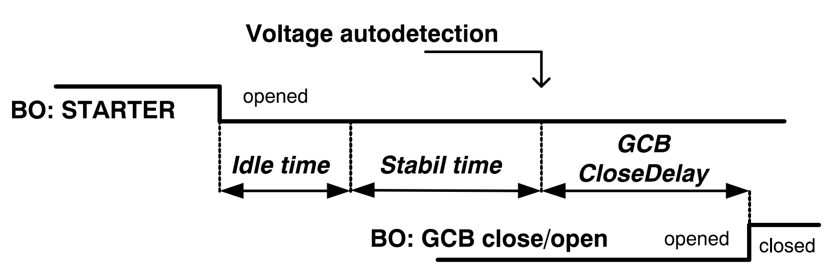


Table 4-15 Engine Setpoints Continued

Cooling time	Runtime of the unloaded gen-set to cool the engine before stop. Step: 1s; Range: 0 - 3600 s
AfterCoolTime	Runtime of engine after cooling pump. Binary output Cooling pump is closed when the engine starts and opens AfterCool time delayed after gen-set stops. Step: 1s Range: 0 - 3600s
CoolingSpeed	Selects the function of the Binary output IDLE/NOMINAL during engine Cooling state. NOMINAL : Cooling is executed at Nominal speed and generator protections are active. IDLE: Cooling is executed at Idle speed and generator protections are switched off. Hint: Binary output IDLE/NOMINAL must be configured and connected to speed governor. Engine Idle speed must be adjusted on speed governor.
D+ function	ENABLED: The D+ terminal is used for both functions "running engine" detection and charge fail detection. CHRGFAIL: The D+ terminal is used for charge fail detection only DISABLED: The D+ terminal is not used. Note: Magnetization current is independent of this setpoint value.

Table 4-16 Engine Protect Setpoints

ECUFreqSelect	This setpoint should be used only for Volvo and Scania engines.
ECU Speed Adjust	This setpoint should be used only for Volvo and Scania engines.
WTBF Accept RPM	The WtBfAcceptRPM delay setpoint will start to count down since cranking. Controller waits before communicating with the ECU for this time. This is because the JD engine passes some erroneous RPM signals during the first 500ms. Step: 0,1s Range: 0 - 3s
Eng prot del	During the start of the gen-set, some engine protections have to be blocked (e.g. Oil pressure). The protections are unblocked after the Protection del time. The time starts after reaching Start RPM. Step: 1s; Range: 0 - 300 s
Horn timeout	Max time limit of horn sounding. Set to zero if you want to leave the output HORN open. Step: 1s; Range: 0 - 600 s
Overspeed	Threshold for over speed protection. Step: 1% of nominal RPM; Range: 100 - 150%
Wrn Oil press	Warning threshold level for ANALOG INPUT 1. Step: 1 psi; Range: Sd Oil press - 10000
Sd Oil press	Shutdown threshold level for ANALOG INPUT 1. Step: 1 psi; Range: -100 - Wrn Oil press
Oil press del	Delay for ANALOG INPUT 1. Step: 1 s; Range: 0 - 180
Sd Water temp	Warning threshold level for ANALOG INPUT 2. Step: 1 °C; Range: Wrn Wtemp - 10000
Wrn Water temp	Warning threshold level for ANALOG INPUT 2. Step: 1 °F; Range: Wrn Wtemp low - Sd Water temp
Wrn Wtemp low	Warning threshold level for low value on ANALOG INPUT 2. Step: 1 °F; Range: -100 - Wrn Water temp
Water temp Low del	Delay for ANALOG INPUT 2 Wrn Wtemp low. Step: 1 s; Range:1-180 s
Water temp del	Delay for ANALOG INPUT 2 alarm. Step: 1 s; Range: 0 - 180 s
Wrn Fuel Level	Warning threshold level for ANALOG INPUT 3. Step: 1 %; Range: Sd Fuel Level - 10000
Sd Fuel Level	Shutdown threshold level for ANALOG INPUT 3. Step: 1 %; Range: -100 - Wrn Fuel Level
Fuel Level del	Delay for ANALOG INPUT 3. Step: 1 s; Range: 0 - 180 s
Batt overvolt	Warning threshold for high battery voltage. Step: 0,1 V; Range: Batt undervolt - 40V
Batt undervolt	Warning threshold for low battery voltage. Step: 0,1 V; Range: 8V - Batt overvolt
Batt volt del	Delay for low battery voltage alarm. Step: 1s; Range: 0 - 600 s
NextServTime	Counts down when engine running. If reaches zero, an alarm appears. Step: 1h; Range: 0 -65535h

Table 4-17 Generator Protect Setpoints

Overload	Threshold for generator overload (in % of Nominal power) Step: 1% of Nominal power; Range: 0 - 200%
Overload Wrn	Threshold for generator overload warning (in % of Nominal power) Step: 1% of Nominal power; Range: 0 - 200%
Overload del	Delay for generator overload alarm. Step: 0.1s; Range: 0 - 60.0 s
Ishort	Shutdown occurs when short circuit limit Ishort limit is reached. Step: 1 % of Nominal current; Range: 100 - 500 %
2Inom del	IDMT curve shape selection. 2Inom del is Reaction time of IDMT protection for 200% overcurrent Igen = 2* Nominal current. Step: 0,1 s; Range: 0,1 - 20 s IDMT is “very inverse” generator over current protection. Reaction time is not constant but depends on generator over current level according following formula. Reaction time is limited up to 900 sec = 15 minutes. IDMT protection is not active for Reaction time values longer than 15 minutes. $\text{Reaction Time} = \frac{\text{2Inom del} * \text{Nomin current}}{\text{Igen} - \text{Nomin current}}$
Curr unbal	Threshold for generator current asymmetry (unbalance). Step: 1% of Nominal current; Range: 1 - 100% of Nominal current
Curr unbal del	Delay for generator current assymetry. Step: 0.1 s; Range: 0 - 60.0 s
Gen >V	Shutdown level for generator overvoltage. All three phases are checked. Maximum out of three is used. Step: 1% of Nominal voltage; Range: Gen >V Wrn -200%
Gen >V Wrn	Warning level for generator overvoltage. All three phases are checked. Maximum out of three is used. Step: 1% of Nominal voltage; Range: Gen <V Wrn - Gen >V
Gen <V Wrn	Warning level for generator under voltage. All three phases are checked. Minimum out of three is used. Step: 1% of Nominal voltage; Range: Gen <V - Gen >V Wrn
Gen <V	Shutdown level for generator under voltage. All three phases are checked. Minimum out of three is used. Step: 1% of Nominal voltage; Range: 0% - Gen <V Wrn
Gen V del	Delay for generator under voltage and over voltage alarm Step: 0.1s; Range: 0 - 60 s
Volt unbal	Threshold for generator voltage unbalance alarm. Step: 1% of Nominal voltage; Range: 0 - 100% of Nominal voltage
Volt unbal del	Delay for generator voltage unbalance alarm. Step: 0.1s; Range: 0 - 60.0 s
Gen >f	Shutdown level for generator over frequency. Step: 0.1% of Nominal frequency; Range: Gen > Wrn - 200.0%
Gen >f Wrn	Warning level for generator over frequency. Step: 0.1% of Nominal frequency; Range: Gen <f Wrn - Gen >V
Gen <f	Shutdown level for generator under frequency. Step: 0.1% of Nominal frequency; Range: 0.0 - Gen <f Wrn
Gen <f Wrn	Warning level for generator under frequency. Step: 0.1% of Nominal frequency; Range: Gen <f - Gen >f Wrn
Gen f del	Delay for generator under frequency and over frequency alarm. Step: 0.1s; Range: 0 - 60.0 s

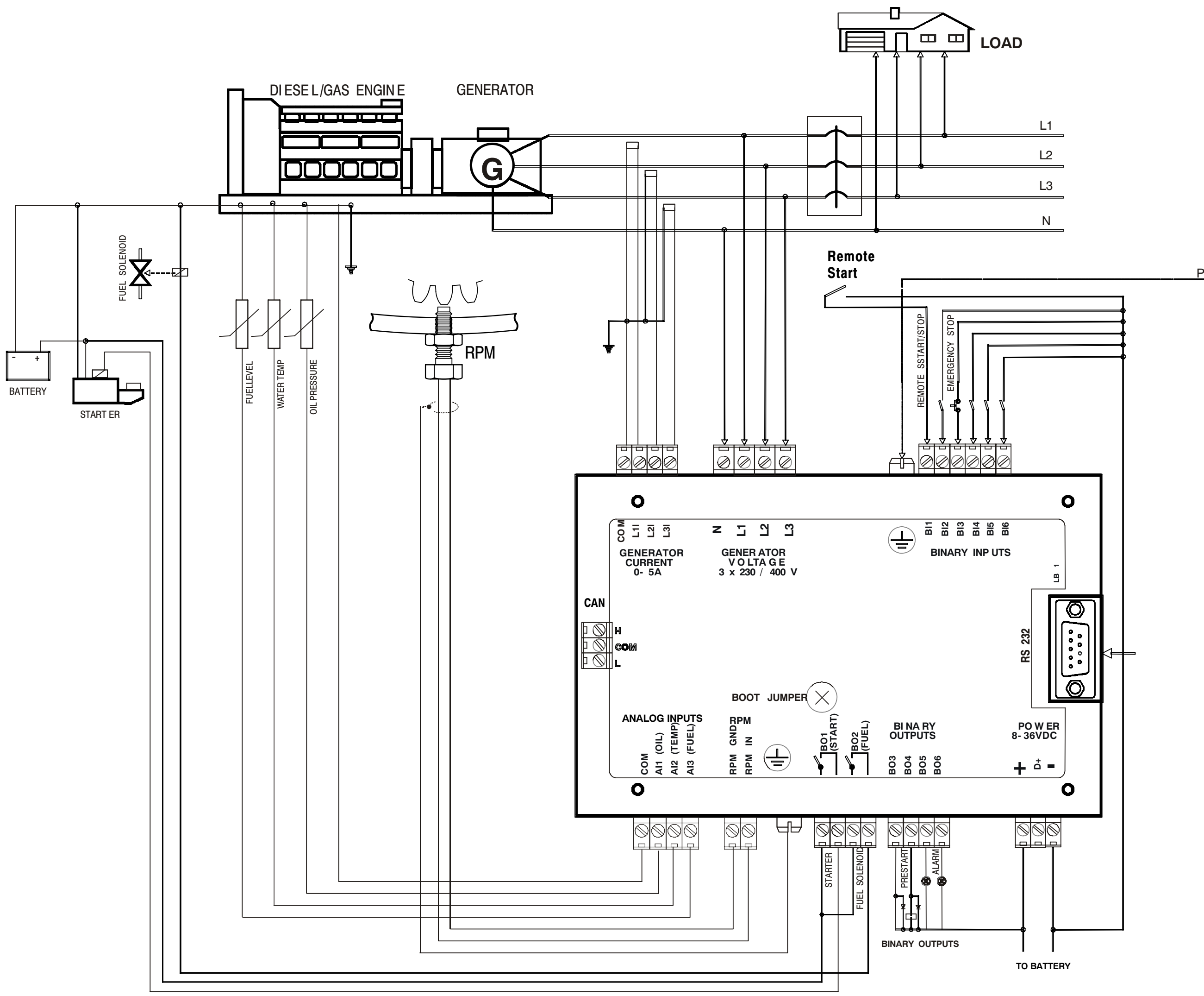
Table 4-18 Sensor Spec Setpoints

Calibr AI1,AI2, AI3	Calibrating constant to adjust the measured value of IL analog inputs. Physical dimension of calibrating constant is corresponding to Analog input. Step: 1; Range: -1000 to +1000
AnOut-kW/20mA	Conversion coefficient from gen-set power to iG-IOM or PTM analog output. Step: 1; Range: 1 to 32000

Table 4-19 IOM/PTM Module Setpoints

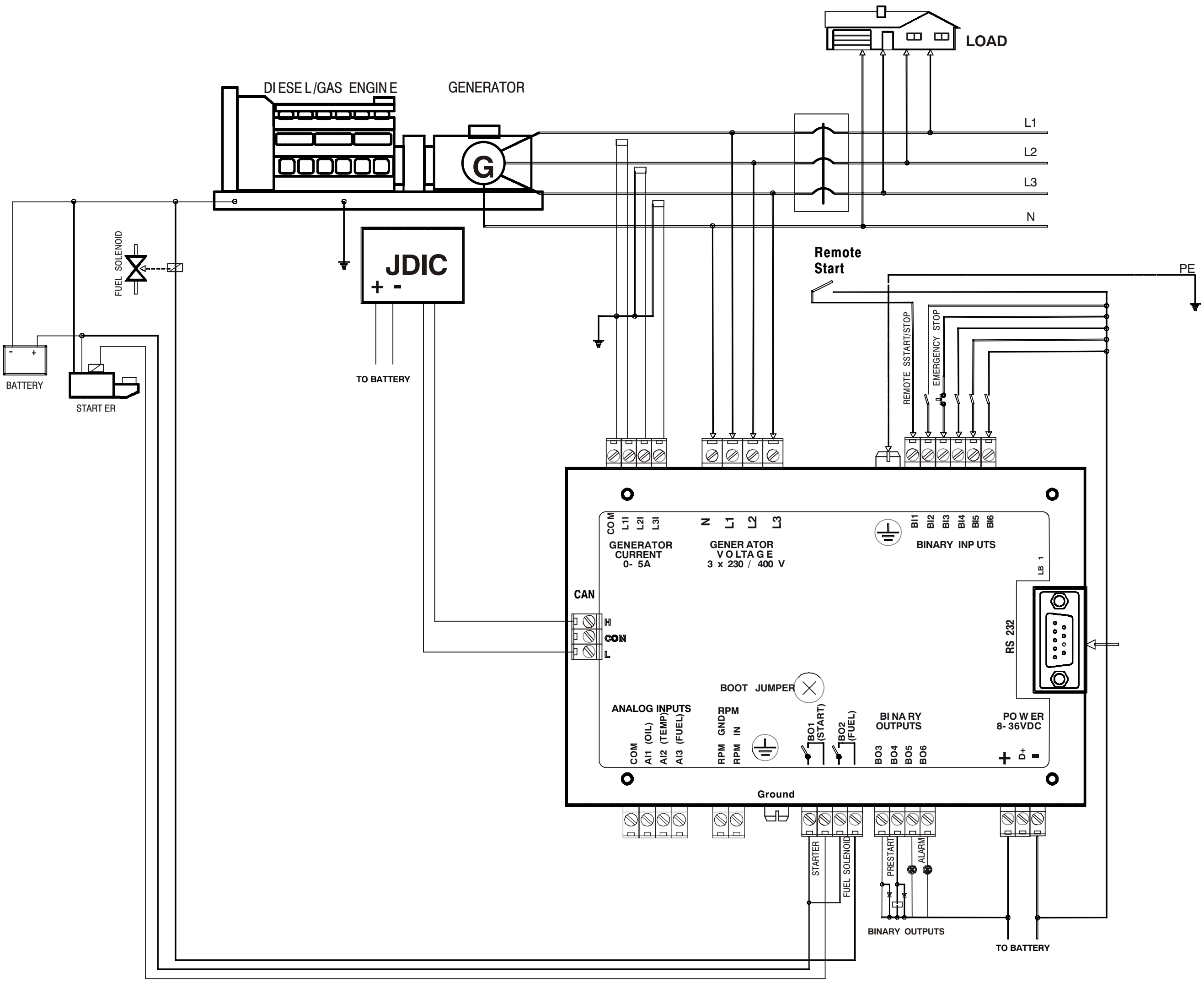
AnlInIOM1 lev1	The level for IOM ANALOG INPUT 1 alarm detection. Step: 1; Range: -100 to +10000
AnlInIOM1 lev2	The level for IOM ANALOG INPUT 1 alarm detection. Step: 1; Range: -100 to+10000
AnlInIOM1 del	Delay for IOM ANALOG INPUT 1 alarm. Step: 1 s; Range: 0 - 180 s
AnlInIOM2 lev1	The level for IOM ANALOG INPUT 2 alarm detection. Step: 1; Range: -100 to +10000
AnlInIOM2 lev2	The level for IOM ANALOG INPUT 2 alarm detection. Step: 1; Range: -100 to +10000
AnlInIOM2 del	Delay for IOM ANALOG INPUT 2 alarm. Step: 1 s; Range: 0 - 180 s
AnlInIOM3 lev1	The level for IOM ANALOG INPUT 3 alarm detection. Step: 1; Range: -100 to +10000
AnlInIOM3 lev2	The level for IOM ANALOG INPUT 3 alarm detection. Step: 1; Range: -100 to +10000
AnlInIOM3 del	Delay for IOM ANALOG INPUT 3 alarm. Step: 1 s; Range: 0 - 180 s
AnlInIOM4 lev1	The level for IOM ANALOG INPUT 4 alarm detection. Step: 1; Range: -100 to +10000
AnlInIOM4 lev2	The level for IOM ANALOG INPUT 4 alarm detection. Step: 1; Range: -100 to +10000
AnlInIOM4 del	Delay for IOM ANALOG INPUT 4 alarm. Step: 1 s; Range: 0 - 180 s The protection of IOM/PTM inputs is activated by over crossing the limits.
Calibr AInIOM 1..4	Calibrating constant to adjust the measured value of IOM/PTM analog inputs. Physical dimension of calibrating constant is corresponding to Analog input. Step: 1; Range: -1000 to +1000

Figure 4-11 Controller Connection Diagram



Digital Engine Controller Description EM0046A21 (MRS17) Continued

Figure 4-12 Controller Connection Diagram

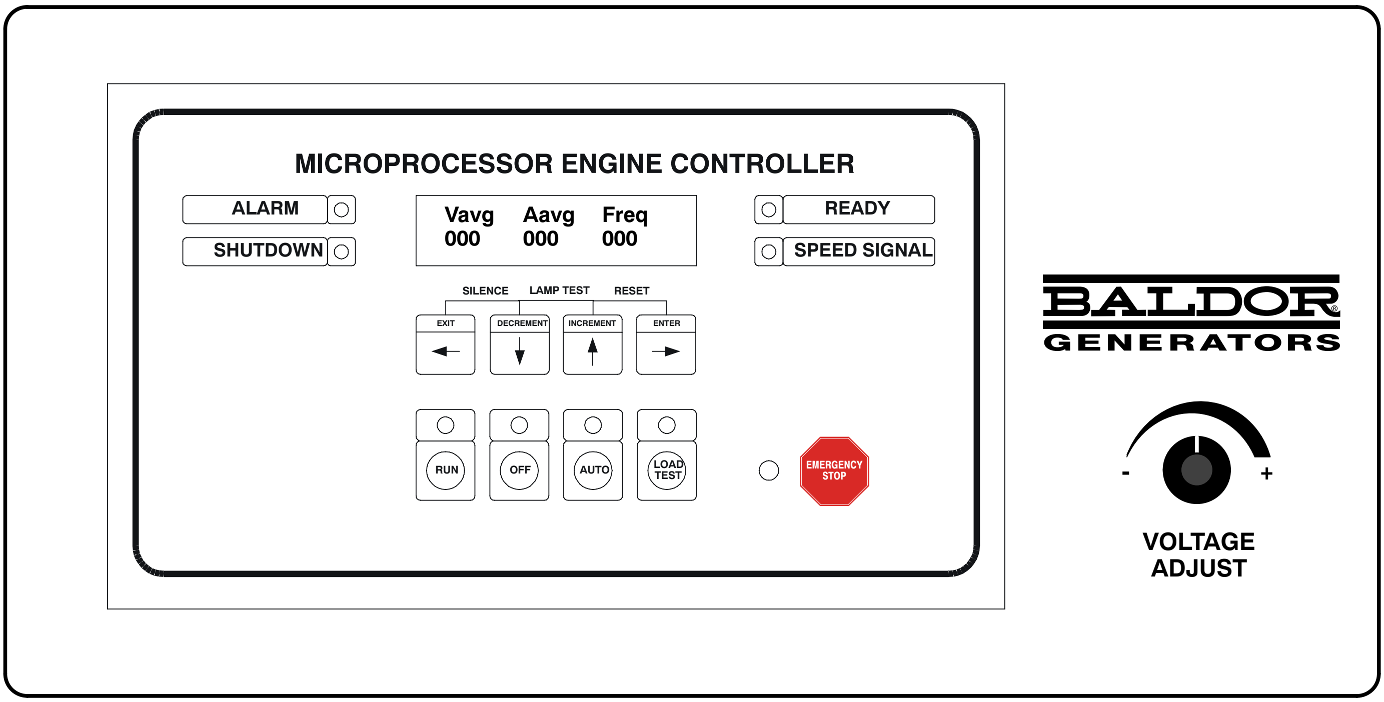


Operator Control Panel (MICROPROCESSOR Engine Controller Only)

The Operator Control Panel is shown in Figure 4-13.

WARNING: Never connect this generator to any buildings electrical system unless a licensed electrician has installed an approved transfer switch. The National Electrical Code (NEC) requires that connection of a generator to any electrical circuit normally powered by means of an electric utility must be connected by means of approved transfer switch equipment so as to isolate the electrical circuit from the utility distribution system when the generator is operating. Failure to isolate the electrical circuits by such means may result in injury or death to utility power workers due to backfeed of electrical energy onto the utility lines.

Figure 4-13 Digital Operator Control Panel



LCD Display - **Vavg** (average voltage) display 0-999 volts.
Aavg (average amperage) display 0-999 amperes.
Freq (frequency) display 0-999 hertz.

Alarm LED- Flashes when a fault is detected.

Shutdown LED- Flashes when a fault is detected.

Ready LED- On when the generator set is ready for automatic operation and no Shutdown or Alarm faults are detected.

Speed Signal LED- On when the engine speed signal is detected (i.e. the engine is cranking).

Emergency Stop LED- On when the Emergency Stop Switch is used to stop the engine.

Emergency Stop Switch- When pushed, the engine is stopped immediately. The engine cannot be restarted until the controller is reset.

Programming Keys
- ← Exit pushbutton used to scroll backward through the status menus or programming prompts to the previous item. Note: The longer the push-button is held down, the faster the menu prompts appear.
- ↓ Decrement pushbutton used to reduce a programming value while in the programming mode. Note: The longer the push-button is held down, the faster the value will be decremented.
- ↑ Increase pushbutton used to increase a programming value while in the programming mode. Note: The longer the push-button is held down, the faster the value will be incremented.
- → Enter pushbutton used to scroll forward through the status menus or programming prompts to the next item. Note: The longer the push-button is held down, the faster the menu prompts appear.

Run Switch- When pushed, initiates a manual start signal to start the engine. The engine will start and operate continuously providing no shutdown faults are active. All protective circuits are operative in this mode. There will be no cool down cycle at the end of a manual run sequence.

Run LED- On when the Run switch is used to start the engine (generator set).

OFF Switch- When pushed, sends a stop signal to the engine to stop the engine.

OFF LED- On when the OFF Switch is used to stop the engine.

Operator Control Panel Continued

Auto Switch - When pushed, initiates automatic operation of the engine (generator set). Starting and stopping of the engine is controlled by a remote contact (transfer switch). When the remote start signal is removed the engine will continue to run for the cool down period (if selected) then stop. Pushing the Off switch will stop the engine immediately, even if the cool down period is not complete.

Auto LED- On when the Auto Switch is used to start automatic operation.

Load Test Switch - When pushed, initiates a load test of the generator set with the associated transfer switch. Only operative for AMF connections or if one of the programmable output contacts is configured for "ATS Test" and the remote transfer switch has remote testing circuitry. When pushed, a signal is issued to the remote transfer switch to permit an automatic engine start and load transfer. Once initiated, the engine will receive a start signal from the transfer switch and upon the generator reaching nominal voltage and frequency levels, a load transfer will be initiated. The generator set will remain running at load until a different operating mode is selected or the generator set develops an alarm or shutdown fault condition.

Load Test LED - On when the load test of the generator set is active.

Special Function Switches

Silence Horn Silence. Press both "Exit and Decrement" at the same time.
This will silence the audible alarm horn without resetting the fail condition.

Lamp Test Press both "Decrement and Increment" at the same time.
Causes the LED's and LCD display to illuminate for approximately 2 seconds then return to their original status.
Note: The emergency stop LED is not affected by this test.

Reset Fault Reset. Press both "Increment and Enter" at the same time.
Resets the controller when in a shutdown mode.
Note: To reset after a fault, the engine must come to a complete stop and the controller's "OFF" switch must be pressed.

Voltage Adjust - Increase or Decrease the Generator output voltage (displayed on VOLTAGE meter)

Operating Procedures

The engine-generator controller is designed to start and stop an engine from either a local ("Manual") or remote ("Automatic") modes. When a start command is issued, the controller issues a run and crank output signal. The controller then monitors engine speed and when crank disconnect speed is reached, the crank signal is terminated. While the engine accelerates to normal speed, the controller continuously monitors the engines speed signal. Should the engine speed exceed the maximum predetermined setpoint, the overspeed shutdown fault circuit will activate, terminating the run signal.

In addition to overspeed shutdown, the engine controller also monitors many other engine protection circuits and should they be activated, the engine will be stopped and/or alarm initiated. The engine will automatically stop for any shutdown condition, or when the remote and/or local start signal is removed. The engine controller operation includes time delay circuits for normal operating conditions such as start delays, cool down and cranking periods.

Manual Start/Stop

To manually Start the Gen-Set, push the "RUN" push-button. The following happens:

1. When the "RUN" push-button is pressed, an ENGINE START DELAY timer is initiated. (The start sequence will not be initiated if any shutdown fault condition is present.)
2. When the engine start delay time expires, an engine RUN and CRANK output signal will be initiated. (The RUN output may be programmed to only energize when a start signal is initiated and an engine speed signal is detected.)
3. When the engine starts and begins to accelerate to nominal speed, the controllers speed sensor will terminate the CRANK output when engine speed reaches approximately 20% speed (i.e. CRANK DISCONNECT speed setpoint). Immediately upon reaching crank disconnect speed, the controller will initiate the BYPASS DELAY time delay function. After the BYPASS DELAY time period (typically 10 seconds) all fault circuits programmed as BYPASS DELAY=YES are active. (All fault circuits programmed as BYPASS DELAY=NO are continuously armed irrespective of any operation sequence.)

To manually Stop the Gen-Set, push the "OFF" push-button. The controllers RUN output will be immediately terminated which will initiate the engine stop sequence.

Automatic Start/Stop

To setup the generator for automatic operation, pressing the "AUTO" push-button.
The following happens:

1. The engine will automatically start upon activation of the remote start contact input. The remote device initiates a start sequence upon contact closure.
2. When the remote start signal is activated, the engine will start as per the sequence of operation described for the manual start sequence.
3. The automatic stop sequence will be initiated by removal of the remote start signal.
4. When the start signal is removed, a cool down delay function will be initiated.

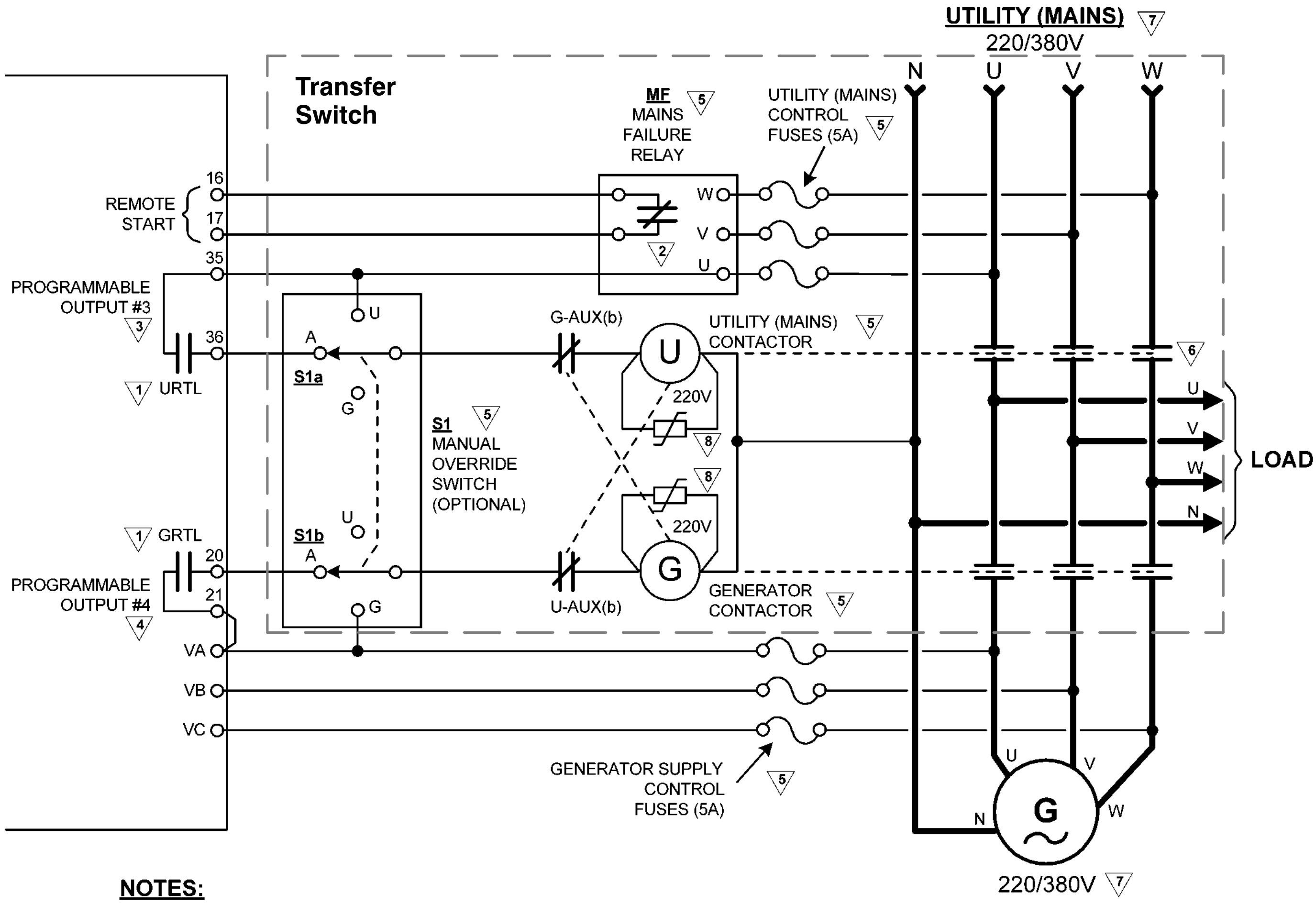
5. When the cool down time delay period expires (typically 5 minutes), the controllers RUN output will be immediately terminated which will initiate the engine to stop.

Automatic Fault Shutdown

When a fault circuit is programmed as a SHUTDOWN, the engine will immediately stop when the fault is activated. A specific shutdown fault can be programmed with a definite time transient delay period that must expire before the shutdown is activated. The stop sequence will cause the controllers RUN output to be immediately terminated which will cause the engine to stop. This will prevent subsequent operation of the generator set. The Run/Stop/Auto selector switch on the operator control panel must be momentarily placed in the “Stop” position to reset the fault.

Automatic Mains Failure (AMF)

Figure 4-14 Auto Mains Failure (AMF) Connections



NOTES:

1. CONTACTS RATED 10A, 240VAC RESISTIVE
2. MAINS FAILURE CONTACT CLOSES WHEN VOLTAGE DROPS BELOW SETPOINT
3. PROGRAMMABLE OUTPUT #3 MUST BE PROGRAMMED FOR "UTILITY READY TO LOAD"
4. PROGRAMMABLE OUTPUT #4 MUST BE PROGRAMMED FOR "GENERATOR READY TO LOAD"
5. ALL COMPONENTS SHOWN EXTERNAL TO THE MEC 2 / MEC 20 ARE OPTIONAL ITEMS
6. 3 POLE CHANGEOVER SWITCH SHOWN
7. FOR OTHER SYSTEM VOLTAGE APPLICATIONS, CONSULT TTI FACTORY
8. AC COIL SPIKE SUPPRESSION DEVICES ARE REQUIRED

When the controller is applied in an Auto Mains Failure (AMF) application with a transfer switch, it must be wired as shown in Figure 4-14. Programmable output #3 must be selected for Utility Ready To Load and programmable output #4 must be selected for Gen Ready To Load. After the controller is programmed, the AMF sequence of operation will be as follows:

Utility Normal Condition:

1. Remote Start input signal (terminals 16 & 17) is not activated (i.e. normal).
2. Utility Ready To Load output is energized (i.e. signal to transfer switch to transfer to utility power).
3. Generator Ready To Load output is de-energized.

Utility Power Failure Conditions:

1. Remote Start input signal is activated (i.e. remote start contact closes when utility power fails, as sensed by utility voltage sensor).
2. Engine starts after the Engine Start Delay timer (Utility Ready To Load output stays energized).
3. After the engine has started and the generator output rises above the programmed voltage and frequency limits, a Warm-Up timer is initiated.
4. After the Warm-Up timer expires the Utility Ready to Load output de-energizes and the NEUTRAL Delay timer is initiated.
5. After the NEUTRAL DELAY timer expires the Gen Ready to Load output energizes to signal the transfer switch to transfer to the generator supply. Note: The neutral delay function is only operative with an electrically-held type transfer switch mechanism (ie. electrical contactor type).

Utility Power Restored:

1. Remote Start input signal is removed and the Return Delay timer is initiated (i.e. Utility Voltage returns to normal and the Utility voltage sensor contact opens).
2. After the Return Delay timer expires, the Generator Ready to Load output de-energizes and the Neutral Delay timer is initiated.
3. After the Neutral Delay timer expires the Utility Ready to Load output energizes to signal the transfer switch to transfer to the utility supply. Note: If the generator has a shutdown during the Return or Neutral Delay periods, the timers are bypassed, and the Utility Ready to Load output immediately energizes.
4. The generator Cool down Timer starts after the Return Delay timer.
5. The generator stops after the Cool down Timer.

Load Test Push-button Operation

1. When the Load Test pushbutton is pressed, the logic will internally simulate receiving a remote start input.
2. Engine starts after the Engine Start delay timer.
3. After the engine has started and the generator output rises above the programmed voltage and frequency limits, a Warm-Up timer is initiated.
4. After the Warm-Up timer expires the Utility Ready to Load output de-energizes and the Neutral Delay timer is initiated.
5. After the Neutral Timer expires the Gen Ready To Load output energizes to signal the transfer switch to transfer to the generator supply.

Note: If a generator shutdown occurs during a Load Test Operation, the Load Test mode will be de-activated.

When Auto Mode is restored (after Load Test Operation) the following occurs:

1. Simulated Remote Start input signal is removed.
2. Gen Ready To Load output de-energizes, and Neutral Delay timer is initiated.
3. After the Neutral Delay timer expires The Utility Ready To Load output energizes to signal the transfer switch to transfer to the utility supply.
4. The generator Cool down timer starts timing following the transfer to the utility supply.
5. The generator stops after the Cool down timer.

No Load Test
To allow a timed No Load Test of the engine/generator set while using the AMF control application, a digital input contact from an external timer must be programmed for NO LOAD Test The sequence of operation for a No Load Test condition is as follows:

1. With the utility supply normal and the generator stopped, a no load test sequence may be initiated by closing an external exercise timer contact to the programmed digital input for No Load Test.
2. After the external exercise timer contact closes, the engine will start and come-up to normal operating speed and voltage. The controller will issue an alarm of a No Load Test condition. The connected transfer switch will remain on the utility and the generator will not transfer on load. Note: should the utility supply fail, the generator will automatically transfer on load.
3. The engine will continue to run as long as the external exercise timer contact remains closed.
4. After the external exercise timer contact opens, the engine will continue to run for its cool down time as programmed, then it will automatically stop.

Standard Faults

When a fault occurs, information about the fault is displayed. The engine controller has many analog and digital inputs for monitoring and control operations. Three types of faults are used:

1. Internal Faults are derived from a combination of digital and analog inputs.
2. Digital Input Faults are initiated from external contact inputs.
3. Analog Input Faults are initiated from external analog signal inputs.

Figure 4-15 shows how the controller inputs and outputs are organized.
A description of each is provided.

Internal Faults

Overspeed Shutdown
Overspeed Shutdown is initiated when the engine's speed has increased above the overspeed setpoint. The overspeed fault circuit is internally programmed as a latching shutdown fault. The overspeed shutdown fault circuit is programmable for the percentage of nominal engine speed (i.e. overspeed setpoint) and for the transient time delay period. The programming prompts for overspeed are located in the main menu programming loop.

Loss of Speed Alarm/Shutdown
Loss Of Speed is initiated when the engine's speed sensing circuit does not detect a speed signal for a period more than 2 seconds following a run signal. The loss of speed fault may be user programmed as a latching shutdown fault or alarm only. The programming prompts for loss of speed are located in the main menu programming loop.

Overcrank Shutdown
Overcrank Shutdown is initiated when the engine fails to start after the selected crank time or number of crank cycles. The overcrank fault circuit is internally programmed as a latching shutdown fault and is not user programmable.

Switch not in AUTO
Switch not in AUTO is initiated when the controller's operating mode switch is changed from the auto position to any other position (ON the keypad). This fault is internally programmed as a non latching alarm. In the main programming loop, this alarm may be user programmed to initiate the common fail output relay.

Digital Input Faults

Digital Inputs (N/O or N/C)
Four digital faults are provided and these are user programmable. Each digital fault input circuit is activated by a remote sensing contact that is external to the controller. Each digital fault input circuit may be programmed with a unique fault label description as stored in the controller's non-volatile memory.
Factory settings have four standard digital faults as follows:

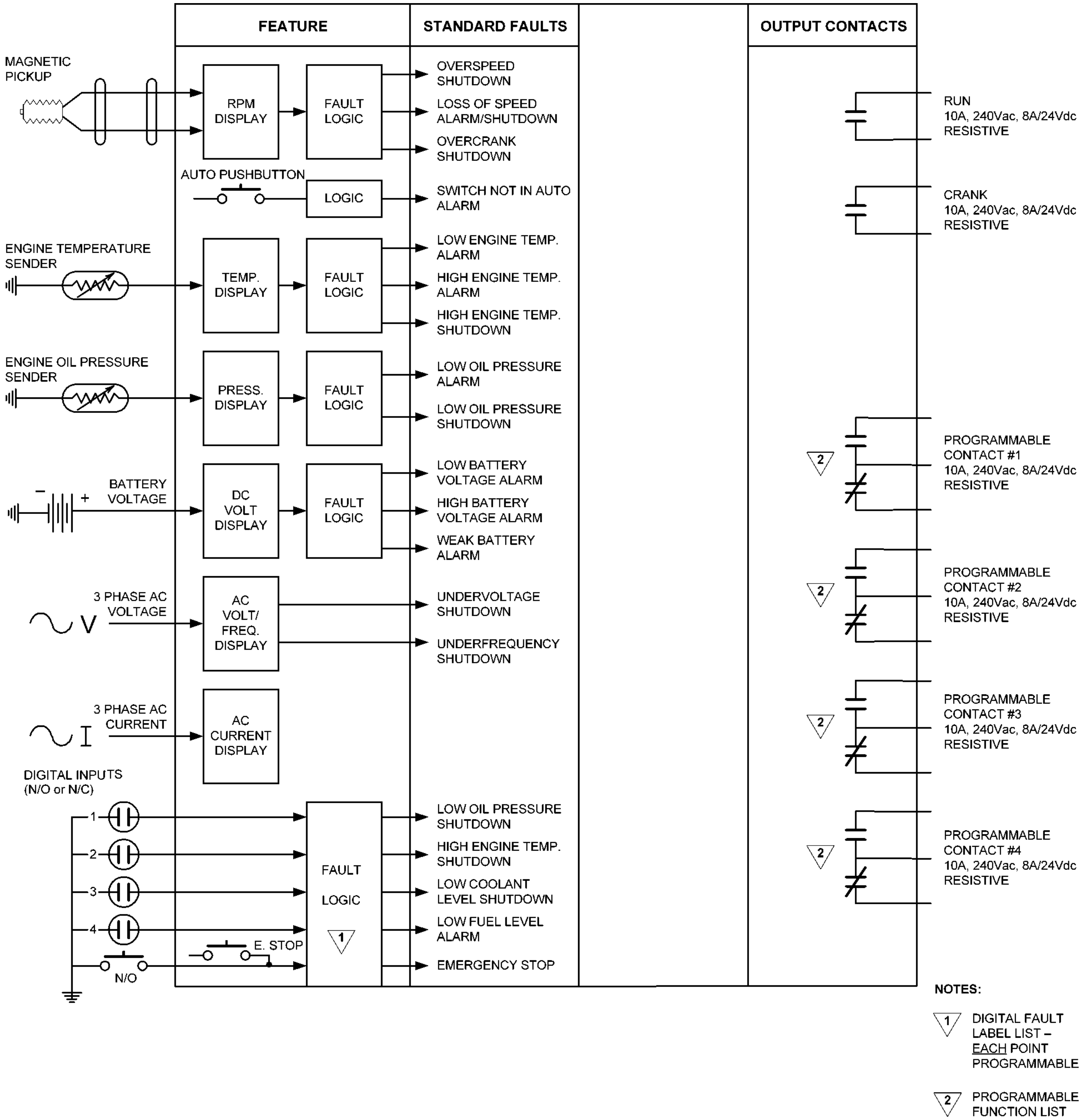
Fault Name	Fault Action	Digital Inputs Terminal #
Low Oil Pressure	Shutdown	1
High Engine Temperature	Shutdown	2
Battery Charger Input Fail	Alarm	3
Low Fuel Level	Alarm	4

The following is a list of all digital faults:

High Bearing Temp	Failed To Sync	Reverse Power	Bat Charger Input Fail
High Cooler Vibration	Low Fuel Press	Fail To Sync	Bat Chrg Trouble
High Engine Temp	Low Engine Temp	Vent Damper Fail	Bat Charger Fail
High Engine Vibration	Low Oil Pressure	Gen Breaker Open	DC Fail
High Fuel Level	Low Fuel Level	Ground Fault	Breaker Tripped
High Oil Level	Low Oil Level	No Load Test	Basin Rupture
High Oil Temp	Fuel Leak	ATS In Bypass	
High Winding Temp	Low Fuel Press	Remote Emerg. Stop	
*Highintkmanftemp	Low Coolant Level	Air Damper Tripped	

"Blank" (i.e. no text for unused inputs)

Figure 4-15 Engine Controller Inputs & Outputs



Analog Faults

Eight analog fault inputs are user programmable for 12 fault conditions. Each analog fault input requires a specific analog signal type.

Fault Name	Fault Action	Inputs Signal
Low Engine Temperature	Alarm	Engine Temperature
High Engine Temperature #1	Alarm	Engine Temperature
High Engine Temperature # 2	Shutdown	Engine Temperature
Low Oil Pressure #1	Alarm	Oil Pressure
Low Oil Pressure #2	Shutdown	Oil Pressure
Low Battery Voltage	Alarm	Battery Voltage
High Battery Voltage	Alarm	Battery Voltage
Weak Battery	Alarm	Battery Voltage
Undervoltage	Shutdown	Voltage
Under frequency	Shutdown	AC Frequency

Low Engine Temperature — An analog DC signal is provided from an engine mounted sender. The low engine temperature fault is activated when engine temperature is below a pre-determined setpoint for a specified time delay. This fault is programmable for temperature setpoint level, transient time delay settings and other functions.

High Engine Temperature #1 — An analog DC signal is provided from an engine mounted sender. The high engine temperature fault is activated when engine temperature is above a pre-determined setpoint for a specified time delay. This fault is programmable for the level of temperature setpoint, transient time delay settings and other functions.

High Engine Temperature # 2 — An analog DC signal is provided from an engine mounted sender. The high engine temperature fault is activated when the engine temperature rises above a pre-determined setpoint for a specified time delay. This fault is programmable for the level of temperature setpoint, transient time delay settings and other functions.

Low Oil Pressure #1 — An analog DC signal is provided from an engine mounted sender. The low oil pressure alarm fault is activated when the oil pressure is below a pre-determined setpoint for a specified time delay. This fault is programmable for pressure setpoint level, transient time delay settings and other functions.

Low Oil Pressure #2 — An analog DC signal is provided from an engine mounted sender. The low oil pressure shutdown fault is activated when the oil pressure is below a pre-determined setpoint for a specified time delay. This fault is programmable for pressure setpoint level, transient time delay settings and other functions.

Low Battery Voltage — The low battery voltage alarm fault is activated when the battery voltage drops below a pre-determined setpoint for a specified time delay. This fault is programmable for the voltage setpoint level, transient time delay settings and other functions.

High Battery Voltage — The high battery voltage alarm fault is activated when the battery voltage rises above a pre-determined setpoint for a specified time delay. This fault is programmable for voltage setpoint level, transient time delay settings and other functions.

Weak Battery — The weak battery alarm fault is activated when the battery voltage drops below a pre-determined setpoint for a specified time delay. The weak battery alarm detects a low capacity (i.e. "weak") battery condition during the cranking cycle. The weak battery alarm is programmed for a lower battery voltage setpoint and shorter time delay than the low battery alarm function. This fault is programmable for voltage setpoint level, transient time delay settings and other functions.

Undervoltage — All 3-phases of the generator output are monitored for an undervoltage condition. The undervoltage sensor is programmable for type of fault action (alarm or shutdown), pickup and dropout voltage setpoints (i.e. adjustable hysteresis) and transient time delay settings.

Under frequency — The generator output is monitored for an under frequency condition. The under frequency sensor is programmable for type of fault action (alarm or shutdown), frequency setpoint, and transient time delay settings.

Engine Speed Analog Input — A magnetic pickup (engine speed sensor) measures engine speed. The engine speed sensor allows the controller to perform the following control functions:

- Overspeed shutdown
- Crank Disconnect control
- Loss of speed signal detection
- Starter Re-engage control
- RPM display

Output Contacts All output contacts are non-powered (i.e. dry contacts) and are rated 10A/240VAC, 8A/28VDC resistive (3A inductive, 0.4pf). Output contacts are not fused therefore external overcurrent protection (maximum 10A) is required for all control circuits using these contacts. Contacts are shown in a de-energized state and will change state upon activation.

Run — The Run contact is a Form "A" dry contact to control the engines "Run" circuit. This typically includes external control devices such as "Fuel Rack Solenoids" or electronic governors.

Note: An additional pilot relay will be required to energize high current devices that exceed the 10A resistive rating. The run output control logic provides an "Energize To Run Signal" (i.e. the run contact closes when a run condition is activated).
For energize to stop control logic, refer to the programmable output control function.

Crank — The Crank output contact is a Form "A" dry contact and is used to control an external crank pilot relay that directly controls the engine starter motor.

Note: An external crank pilot relay is required to energize the high current starter motor pinion solenoid that exceeds the 10A resistive crank output contact rating. The crank output contact closes when a crank condition is activated and the contact will automatically open when crank disconnect speed is obtained and/or the generators output AC voltage exceeds 10% of nominal level. The generators output AC voltage is utilized for back-up crank disconnect protection should the speed sensor fail.

Programmable Contacts — Four (4) standard programmable output contacts are provided, #1, #2, #3 and #4. Each programmable output is a Form "C" dry contact that is programmable for any of the following conditions:

- Energize To Stop — The output relay will energize when a stop signal has been activated. The output will remain energized for 10 seconds after the engine has come to a complete stop, then de-energizes.
- Switch Not In Auto — The output relay will energize when the controller's operation mode switch is not in the auto position.
- Engine Ready — The output relay will energize when the controller's mode switch is in the auto mode and no shutdown or alarm conditions are present.
- Preheat — The output relay will energize during the start delay timer period and cranking period until the engine starts and reaches crank disconnect speed. The preheat output is typically used for an engine starting aid such as glow plugs.
  Note: An external pilot relay is required to switch the high current glow plug load.
- GEN Ready To Load — The output relay will energize when the generators output voltage and frequency exceeds predetermined setpoints (e.g. voltage 90% nominal, frequency 95% nominal as user programmed) and a warm-up time delay period expires. After the output has energized, it will remain on (regardless of voltage/frequency levels) until the controller either has a stop/shutdown signal, or the engine's speed drops below crank disconnect level. The voltage, frequency and time delay levels are programmable. This output is typically used in an Auto Mains Failure (AMF) application.
- Utility Ready To Load — The output relay will energize when the remote start input has not been activated (i.e. contact on terminals 16 & 17 not closed) and the Return Delay & Neutral Delays have expired (if programmed). The output will de-energize when the remote start input has been activated and the Engine Start Delay & Warm-Up Delays have expired (if programmed). This output is typically used for Auto Mains Failure (AMF) applications.
- Engine Running — The output relay will energize when the engine has started and has reached crank disconnect speed.
- Engine Run (Fuel) — The output relay will energize when the engine "RUN" (i.e. FUEL) energizes prior to the engine starting. The output will remain on until the engine has reached a "stop" or "shutdown" command.
- Airflap — The output relay will energize when the engine's speed exceeds the overspeed setpoint level. The output will remain energized until the engine's speed drops below the low speed setpoint (typically 5% of rated speed).
  Note: An external pilot relay is required if the main air flap solenoid current rating exceeds the contact rating.
- ATS Test — This feature is only operative if the remote transfer switch is interconnected with remote testing capability.
  The output relay will energize when a load test operating mode is selected by the "Load Test" keypad push-button. After initiated, the engine will receive a start signal from the transfer switch and when the generator reaches nominal voltage and frequency levels, a load transfer will be initiated. The generator set will remain running on load until a different operating mode is selected or the generator set develops an alarm or shutdown condition.
  Note 1: When the "Utility Ready to Load" and "Generator Ready to Load" outputs are programmed, the "Load Test" programmable output is not required as the engine starting logic is internally initiated.
  Note 2: When both "Utility Ready to Load" and "Generator Ready to Load" outputs are programmed for an AMF control configuration, the ATS Output is not used (i.e. engine start signal is internally generated).
- Oil Bypass Timer Complete — The output relay will energize when the controller's oil bypass delay timer expires, following a normal start sequence.
- Common Alarm — The output relay will energize when any alarm fault has been activated.
- Common Fail — The output relay will energize when any alarm or shutdown fault has been activated.
- Common Shutdown — The output relay will energize when any shutdown fault has been activated.
- EPS Supplying Load — The output relay will energize when the engine is running and the generator is supplying current to the load more than or equal to 10% of nominal CT ratio.

Display Modes The controller is in the display mode at all times except when in the programming mode. The display screens and menus may be selected by pressing the Enter or Exit keys to access Operating Status Display, Fault Display, Timer Countdown, Generator AC Metering or Programming Menus. The LCD display shows the status of the generator output:

Operating Status The controller will power-up into an Emergency Stop failure mode, preventing possible engine operation. The controller must be manually reset before normal operation can be established. To reset the Emergency Stop condition, press the "OFF" push-button first, then press both "INCREMENT" and "ENTER" push-buttons simultaneously. The controller will then reset, if a remote emergency stop condition is not activated. The Utility Ready to Load programmable output will energize if the remote start contact is open. The Main LCD Display will be shown.

Action	Description	Display	Comments
Apply Power and Reset faults.	Main LCD Display.	Vavg Aavg Freq 000 000 000	
Press Enter key	Show Operating Status screens	UNIT READY	Controller is in "Auto" position and there are no active faults.
Press ↑ or ↓ key	Scroll to next.	SWITCH IN OFF	Controller is in "OFF" position from the front panel keypad push-button.
Press ↑ or ↓ key	Scroll to next.	UNIT RUNNING	Engine is running and all conditions are normal.
Press ↑ or ↓ key	Scroll to next.	UNIT SHUTDOWN	A shutdown fault is active. The specific fault will be automatically displayed.
Press ↑ or ↓ key	Scroll to next.	UNIT ALARM	One or more faults are active. The display will automatically scroll through all active faults at a two second rate.

Fault Display The fault display menu is automatically displayed when an alarm or shutdown fault is activated. The specific alarm or shutdown fault label will be displayed and if multiple alarm conditions are present, the display will automatically scroll through all active faults.

Timer Countdown Timer countdown menus are automatically displayed when a specific time delay function occurs during a control sequence. When a time delay begins, the LCD display will show the time delay function name (i.e. Engine Start Delay) and the current time remaining in the countdown sequence. When the timing function has expired, the LCD display will automatically change to either the next timing sequence countdown display or return to the original system status menu.

Action	Description	Display	Comments
Apply Power and Reset faults.	Main LCD Display.	Vavg Aavg Freq 000 000 000	
	Show Operating Status screens	ENGINE START DELAY 45 SEC	Displays specific time delay function name and remaining time.

Other time delay functions are:

		ENGINE START DELAY 45 SEC	
		CRANK PERIOD XX SEC	
		REST PERIOD XX SEC	
		STARTER RE-ENGAGE DELAY XX SEC	
		BYPASS DELAY XX SEC	
		COOLDOWN DELAY XXXX SEC	
		WARMUP DELAY XX SEC	
		RETURN DELAY XX SEC	
		NEUTRAL DELAY XX SEC	

Note: Countdown screens only appear if Utility/Gen Ready To Load outputs are programmed.

Generator AC Metering The controller is in the display mode at all times except when in the programming mode. The display screens and menus may be selected by pressing the Enter or Exit keys to access Operating Status Display, Fault Display, Timer Countdown, Generator AC Metering or Programming Menus. The LCD display shows the status of the generator output:

Generator Average Output Display

Vavg	Aavg	Freq
000	000	000

Average Voltage	Displays the average generator voltage as follows: 3-phase system: AVERAGE LINE TO LINE VOLTAGE--Phases 1-phase system: LINE TO LINE VOLTAGE--Phases A to B
Average Current	Displays the average generator current as follows: 3-phase system: AVERAGE LINE CURRENT--Phases A,B,C 1-phase system: AVERAGE LINE CURRENT--Phases A,B
Frequency	Displays generator frequency in hertz (HZ). The frequency is displayed with a resolution of 1/10 of a hertz.

Generator KVA Display

KVA
632.23

KVA	Displays the generator's total power output in kilo-voltamperes (KVA).

Generator Phase Voltage Display (Line to Line)

Vab	Vbc	Vca
600	600	600

Vab	Displays the generator's output voltage: 3-phase system: LINE TO LINE VOLTAGE--Phases A to B 1-phase system: LINE TO LINE VOLTAGE--Phases A to B
Vbc	Displays the generator's output voltage: 3-phase system: LINE TO LINE VOLTAGE--Phases B to C 1-phase system: LINE TO NEUTRAL VOLTAGE--Phases A-N
Vca	Displays the generator's output voltage: 3-phase system: LINE TO LINE VOLTAGE--Phases C to A 1-phase system: LINE TO NEUTRAL VOLTAGE--Phases B-N

Generator Phase/Neutral Voltage Display (Line to Neutral)

Van	Vbn	Vcn
347	347	347

Note: The generator's neutral must be connected to controller terminal TB1-VN and the "neutral connected" prompt in the main program menu must be selected as "Yes".

Van	Displays generator voltage Phase A to Neutral.
Vbn	Displays generator voltage Phase B to Neutral.
Vcn	Displays generator voltage Phase C to Neutral.

Generator Phase Current Display

Amps	a	b	c
	408	451	415

Amps a	Displays generator load current as follows: 3-phase system: PHASE A CURRENT 1-phase system: PHASE A CURRENT
Amps b	Displays generator load current as follows: 3-phase system: PHASE B CURRENT 1-phase system: PHASE B CURRENT
Amps c	Displays generator load current as follows: 3-phase system: PHASE C CURRENT 1-phase system: not applicable

Generator Frequency/Hourmeter Display

FREQ	60.1 Hz
HOURS	56788 Hrs

FREQ	Displays generator frequency in hertz (HZ). The frequency is displayed with a resolution of 1/10 of a hertz.
HOURS	Displays unit operating hours.

Engine Parameter Display Two engine operating parameter screens are provided.

Battery Voltage/Engine Speed (Tachometer)

BATTERY 27.0 Vdc
SPEED 1800 rpm

Battery	Displays battery voltage in DC volts. The voltage is displayed with a resolution of 1/10 of a volt.
Speed	Displays engine speed in revolutions per minute (RPM).

Engine Temperature/Oil Pressure

ENG TEMP 57 Deg C
OIL PRESS 200 KPA

ENG TEMP	Displays engine temperature in either degrees Celsius or Fahrenheit (as selected).
OIL PRESS	Displays engine oil pressure in either pounds per square inch (PSI) or in Kilopascals (KPA) (as selected).

Program Menus

The programming menu is used to change values such as time delays, analog fault settings, digital fault settings. Access to the programming sub-menus may only be obtained with a security password number. The sub menus are organized as follows:

Program Menu

PROGRAM MENU?
NO

Displays two messages that may be toggled between YES and NO by pressing the INCREMENT push-button.
NO Programming sub-menus are disabled when NO is displayed.
YES Programming sub-menus are enabled when YES is displayed and a valid password number is entered.

PASSWORD
0

Press INCREMENT or DECREMENT to change the password. Press ENTER when the correct number is displayed.

Read Only Mode
User can view the parameters but cannot change any values. The factory setting for this level is one (1).

Read / Write Mode
User can view and modify any parameter value. The factory setting for this level is two (2).

Master Read / Write Mode
User can view and modify any parameter value and view/modify the security password level numbers. Contact Baldor for master password if required.

The values of the parameter settings for your generator-set can be recorded for future reference using the Configuration Data Sheet shown in Figure 4-16.

After the correct password number is entered, the you may choose one of four programming menus. Press INCREMENT or DECREMENT to find the desired menu then press ENTER.

MAIN MENU LOOP
ANALOG FAULT MENU LOOP
DIGITAL FAULT MENU LOOP
CALIBRATION MENU LOOP

Navigation Hints

Programming parameters are displayed in the same order as the Programming Sheets (see Figures 4-17 to 4-20). To skip over parameters that do not require changes, push and hold the ENTER push-button until the desired parameter is displayed. The EXIT push-button may be used to scroll backwards through the programming parameter loops.

To change a parameter value, use the INCREMENT or DECREMENT push-buttons to scroll through the available options or to adjust a value as desired and press the ENTER to accept the new value.

Note: If programming mode is terminated before the last change is accepted (pressing ENTER), that parameter value will remain unchanged.

Main Menu Loop The Main Menu Loop contains general system configuration programming such as system input voltages, currents, transformer ratios, as well as standard operating time delay functions.

System Voltage	Set to nominal system voltage as expressed in phase to phase voltage (i.e. a 347/600 volt system would be entered as 600). The programmable range of values is 120V-15,000V.
System Frequency	Set to nominal system frequency of either 50 HZ or 60 HZ.
System Phases	Set to match the power distribution system used on the generator set (i.e. either single phase or 3 phase system).
Neutral Connected	Set to Yes if generator's neutral conductor is connected to controller terminal TB1-VN and it is desired to display line-neutral AC voltages for a 3 phase, 4 wire system.
Voltage Sensing Ratio	For direct voltage sensing wiring connections from 208 to 600 volts, enter 1 (i.e. a ratio of 1:1). When potential transformers are utilized for voltage sensing, enter the calculated transformer ratio (e.g. when using 600:120 transformers, enter a number of 5).
Current Sensing Ratio	For current sensing wiring connections from current transformers (CT's), enter the calculated CT ratio (e.g. when using a 600:5 CT, enter a number of 120).
Temperature Scale	Select the desired units for engine temperature display and analog setpoints: Degrees Fahrenheit or Degrees Celsius. Note: Alarm setpoints do not automatically re-configure when changing between Fahrenheit or degrees Celsius.
Pressure Scale	Select the desired units for engine pressure display and analog setpoints: Pounds per square inch (PSI) or Kilopascals (KPA). Note: Alarm setpoints do not automatically re-configure when changing between PSI and KPA.
Start Delay	Select desired engine start delay time in seconds. If engine start delay is not required, set to zero. Note: If preheat and or prelube functions are used, the engine start delay time should be set as required for these functions.
Crank Time	Select desired cranking time in seconds. If cycle cranking is selected, this time will be the crank time per attempt.
Rest Time	Select desired rest time between cranking attempts. (Only valid if multiple crank attempts are selected). Note: This value will be ignored if only one attempt has been programmed.
Starter Re-Engage Duration	This feature checks for a speed signal during cranking. If no speed signal is sensed, the controller assumes that the engine starter is not turning the engine over and disengages it after the programmed time delay, and re-engages it again. This process will repeat until a speed signal is sensed or cranking time expires, whichever occurs first. If a speed signal is sensed, cranking continues until the engine starts or an overcrank condition occurs. Set time in seconds as desired (i.e. a setting of 5 seconds will attempt cranking for 5 seconds after which time if no speed signal is detected, the crank output will be removed for a preset 1 second delay before re-engaging.) Note: This action is more than a cycle cranking function and is independent of the number of attempts selected. Therefore, the "crank" time should be considered. To disable this feature, set to zero.
Number Of Crank Cycles	Set to the number of cranking cycles required. (Zero will default to one.)
Bypass Delay	This setting is the time period that Alarm or Shutdown faults will be ignored after crank disconnect, allowing the engine to settle into its normal operating mode (i.e. proper oil pressure, etc.). Typically 10 seconds.
Cool down Time	Set to desired cool down time in seconds. Up to 9999 seconds of cool down time may be programmed. Set to zero if not required. Note: If the controller is used in an AMF application it is recommended to set the cool down timer to a minimum of 10 seconds to allow the generator to transfer Off Load before enabling the cool down time. (Ensures the load is transferred off of generator prior to stopping the engine.)
Nominal Engine RPM	Set to the nominal engine speed in revolutions per minute (RPM).
Flywheel Teeth	Set to the number of ring gear teeth on the engine flywheel. The magnetic pick-up must be installed to sense the same teeth for speed sensing as programmed.
Crank Disconnect Speed	Set crank disconnect speed in percentage of nominal speed, i.e. 30% or 540 RPM on an 1800 RPM engine.
Overspeed	Set overspeed shutdown point in percentage of nominal speed (i.e. 110% or 1980 RPM on an 1800 RPM engine).
Overspeed Transient Delay	Select desired overspeed transient delay time in seconds. Time setting may be entered in tenths of seconds.
Run Output Fail-safe	When enabled (factory setting), this feature inhibits the run output until the controller receives a speed sensing signal. This prevents possible damage caused by starting the engine with no speed sensing for crank disconnect and overspeed. If selected, ensure that the speed signal is not less than 3.0VAC from the magnetic pick up while the engine is cranking. Note: If this feature is disabled, no overspeed protection or crank disconnect will be provided if the speed signal fails. If you disable this feature Baldor strongly recommends that backup crank disconnect protection and additional overspeed protection is provided.

Main Menu Loop Continued

Loss Of Speed Signal	Select the desired action (i.e. alarm or shutdown) when a loss of speed signal is detected during operation. Note: A loss of speed signal must be detected for longer than 2 seconds to initiate the desired action.
Common Fail For “Not In Auto” Function	Selects if a common fail alarm condition is to be activated during manual operation.
Horn For Not In Auto	The Horn may be programmed to sound when the controllers operating mode is switched from the Auto position. If the Horn is not to sound, select program setting No.
Warm-up Delay	The WARM-UP Delay menu appears when the Gen Ready To Load programmable output is selected (typically for AMF application). Set to the desired time in seconds, which the generator requires to effectively “warm-up” before accepting load. This is typically set for 3 seconds. The Warm-Up Delay is initiated after the generator is above programmed voltage and frequency limits (per the analog programming menus).
Neutral Delay	The Neutral Delay menu appears when the Utility Ready To Load programmable output is selected (typically for AMF application). The Neutral Delay timer is used when transferring between the available power sources. When transferring from the utility supply to the generator supply, the Neutral Delay timer will start when the Utility Ready To Load output de-energizes. When the Neutral Delay time period expires, the Generator Ready To Load output is energized. The purpose of the Neutral Delay timer is to prevent out of phase transfers, which may be caused by a fast transfer and the two sources of supply are out of synchronism. The Neutral Delay timer ensures the load voltages decay before the transfer is initiated. Set to the desired time in seconds. The Neutral Delay timer is typically set for 3 seconds.

Note: The Neutral Delay feature is only effective when an electrically held “contactor-type” transfer switch is connected. Contact Baldor for further application information on use with other types of transfer switch mechanisms.

Return Delay	The Return Delay menu appears when the Utility Ready To Load output is selected (typically for AMF application). The Return Delay is initiated when the remote start signal is removed (signaling utility power is available). After the Return Delay timer expires, the Generator Ready To Load output is removed, and the Utility Ready To Load output energizes to signal transfer the load back to the utility supply. The purpose of the Return Delay timer is to ensure that the utility power has returned to a steady state for the selected time period before the load is transferred back to the utility supply. The Return Delay timer is typically set for 120 seconds.

Caution: The Programmable Output Contacts selection must agree with the external control wiring prior to energizing the controller. Failure to do so may cause severe equipment damage.

Programmable Output Contacts Select the desired function that will activate the programmable relay output contact. One of the following functions may be selected:

Energize To Stop	Gen Ready To Load	Air Flap Eps Supplying Load	Utility Ready To Load
Oil Bypass Timer Complete	Common Fail	Digital Faults #1 to4	Switch Not In Auto
Overspeed	Engine Ready	Loss Of Speed Signal	Engine Run (Fuel)
Low Bat Voltage	Preheat High Bat Voltage	Engine Running	Weak Bat Voltage
ATS Test	Low Oil Press #1 Alarm	Common Alarm	Common Shutdown
Low Oil Press #2 Shutdown	High Eng Temp #1 Alarm	High Eng Temp #1 Shutdown	

Reset Run Hours	The hourmeter may be reset to zero hours when yes is programmed. Note: This programming prompt is only accessible while using the “Master” programming security password.

Analog Fault Menu Loop The controller’s analog fault settings are described as follows:

Level	Sets the actual analog signal setpoint at which the selected fault type will be activated. Note: For AC voltage fault circuits, two levels (i.e. pick-up & drop-out) must be programmed.
Action	Allows a fault to be either an Alarm fault or a Shutdown fault.
Alarm Latch	If an fault was set as an Alarm, it may be selected as a “Latching” alarm or “Non-latching” alarm. A Latching alarm is not cleared until a reset command clears it. Note: This value only appears if alarm faults are programmed. Shutdown faults are automatically set as latching.
Bypass On Start Delay	Allows the alarm or shutdown fault to be disabled until after the bypass timer has expired. Faults that are not delayed are enabled at all times (i.e. engine running or stopped).
Transient Delay Times	Allows the selected fault to be disabled until the delay period has expired. Delay times are 0.0 to 999.9 seconds.

Digital Fault Menu Loop The controller's digital fault settings are described as follows:

Caution: The Digital Fault Label selection must agree with the external control wiring prior to energizing the controller. Failure to do so may cause severe equipment damage.

Digital Fault Label — Select the desired fault label, these are stored in non-volatile memory.

Air Damper Tripped	High Oil Temp	Bat Charger Input Fail	High Winding Temp
Bat Chrg Trouble	Low Coolant Level	Breaker Tripped	Low Engine Temp
DC Fail	Low Fuel Level	Failed To Sync	Low Fuel Press
Gen Breaker Open	Low Oil Level	Ground Fault	Low Oil Pressure
High Bearing Temp	Remote Emerg.stop	High Cooler Vibration	Reverse Power
High Engine Temp	Basin Rupture	High Engine Vibration	ATS In Bypass
High Fuel Level	Fuel Leak	High Oil Level	Low Fuel Press
No Load Test	Bat Charger Fail	*Highintkmanftemp	Vent Damper Fail
High Fuel Level	Fail To Sync	"Blank" (i.e. no text for unused inputs)	

Action — Allows a fault to be either an Alarm fault or a Shutdown fault.
Note: Any activated alarm or shutdown fault will energize the "Common fail" fault and sound the alarm horn.

Alarm Latch — If an fault was set as an Alarm, it may be selected as a "Latching" alarm or "Non-latching" alarm. A Latching alarm is not cleared until a reset command clears it.
Note: This value only appears if alarm faults are programmed. Shutdown faults are automatically set as latching.

Polarity — Allows the digital fault circuit to be set for Open to Fail or Close to Fail sensing contacts.

Bypass On Start Delay — Allows the alarm or shutdown fault to be disabled until after the bypass timer has expired. Faults that are not delayed are enabled at all times (i.e. engine running or stopped).

Transient Delay Times — Allows the selected fault to be disabled until the delay period has expired. Delay times are 0.0 to 999.9 seconds.

Idle Control Digital Input Programming — When a digital input is set to Idle function, these settings must be programmed to ensure correct operation:

Action	Alarm
Alarm Latch	No
Polarity	Close
Bypass On Start	No
Transient Time	0.1

Note: The corresponding digital output must also be programmed for IDLE to enable correct operation.

No Load Test Control Digital Input Programming

The No Load Test digital input feature is typically used in an AMF application where it is required to do an automatic timed No Load Test of the engine/generator set. A contact from an external exercise clock timer is required to be connected to the digital input circuit which is programmed for "No Load Test". When a digital input is programmed as No Load Test, these settings must be programmed to ensure correct operation:

Action	Alarm
Alarm Latch	No
Polarity	Close Or Open (dependent on external circuit used)
Bypass On Start	No
Transient Time	0.1

Calibration Menu Loop AC Voltage, AC current and battery voltage analog circuits are factory calibrated and should not require field calibration. If field calibration is required, refer to the calibration procedure.

Voltage Sensing Calibration (Phase To Phase or Phase To Neutral)

```
VOLTS AB  ZERO
   99        600V
```

Displays the generator phase voltages to be calibrated.
Displays the type of calibration function, either ZERO or SPAN.
Displays the calibration correction factor number (0-255) used to obtain the correct voltage reading.
Note: To correctly calibrate any of the voltage sensors, the ZERO function must be calibrated before the SPAN function.
Displays the actual voltage measurement that will be the same value as shown on the MEC 2 display menus for generator supply. This voltage reading may be calibrated higher or lower by changing the correction factor number.

Voltage Calibration Procedure

Note: Zero Calibration must be completed before Span Calibration.

Zero Calibration — Connect an external AC voltmeter of adequate voltage range and accuracy to the MEC 2 controller terminals associated with the voltage phases to be calibrated. With the generator stopped, confirm there is Zero volts on the phases to be calibrated. In the programming mode, scroll to each of the desired generator supply voltage phases (i.e. phase to phase or phase to neutral) with the ZERO function selected. Use the INCREMENT or DECREMENT push-buttons to adjust the correction factor number to obtain zero volts on the right hand side of the display as confirmed with the external voltmeter. The factory default correction factor is 127. Increasing this will raise the displayed value, conversely decreasing this value will decrease the displayed value. Note: Adjusting the ZERO function with voltage applied will result in non-linear voltage readings.
With the correct voltage displayed, press the ENTER push-button to accept the correction factor number. Record the correction factor number on the programming sheet for future reference. Repeat this procedure for all remaining phases.

Span Calibration

Energize the generator supply voltage to the controller at nominal level. Note: It may be necessary to program the optional under and over voltage shutdowns as alarms to ensure the generator will continue to operate during calibration. Caution must be taken to ensure the generator output voltage is set within nominal limits. In the programming mode, scroll to the desired generator supply voltage phases with the SPAN function selected. Connect an external AC voltmeter of adequate voltage range and accuracy to the controller terminals associated with the voltage phases to be calibrated. Use the INCREMENT or DECREMENT push-buttons to adjust the correction factor number while observing the displayed voltage level. Adjust the correction factor number to obtain an identical voltage reading as measured with the external AC voltmeter. With the correct voltage displayed, press the ENTER push-button to accept the correction factor number. Record the correction factor number on the programming sheet for future reference.

Note: When the span calibration setting is complete, re-confirm the zero calibration points. If the zero calibration setpoint needs further adjustment, the span calibration point must also be re-calibrated.

Current Sensing Calibration

To accurately calibrate the current sensors, an external test AC ammeter and current clamp is required, with an accuracy of 0.5% or better.

```
CURRENT A  ZERO
     99          350A
```

Displays the generator load current (phase A, B or C) to be calibrated.
Displays the type of calibration function, either ZERO or SPAN.
Displays the calibration correction factor number (0-255) used to obtain the correct current reading.
Note: To correctly calibrate any of the current sensors, the ZERO function must be calibrated before the SPAN function.
Displays the actual current measurement that will be the same value as shown on the MEC 2 display menus for generator supply. This current reading may be calibrated higher or lower by changing the correction factor number.

Zero Calibration

Connect an external AC ammeter with current clamp of adequate current range to the controller terminals associated with the current phases to be calibrated. With the generator stopped, confirm there is “0” current on the phases to be calibrated. In the programming mode, scroll to each of the desired generator supply current phases with the ZERO function selected. Use the INCREMENT or DECREMENT push-buttons to adjust the correction factor number while observing the displayed current level. Adjust the correction factor until “0” amps is displayed.
With the correct current displayed, press the ENTER push-button to accept the correction factor number. Record the correction factor number on the programming sheet for future reference. Repeat for each phase.

Span Calibration

Apply 50%-100% load to the generator set. It is recommended to load the generator set to 100% rated load for calibration purposes to obtain good accuracy throughout the full span of operation. Do not exceed the current rating of the CT. Non-linear output of the CT will result when the secondary current exceeds 5 amps and will similarly effect the displayed values.
In the programming mode, scroll to the desired generator supply current phases with the SPAN function selected. Connect an external AC ammeter and current clamp of adequate current range to the controller terminals associated with the current phases to be calibrated. Use the INCREMENT or DECREMENT push-buttons to adjust the correction factor number while observing the displayed current value. Adjust the correction factor number to obtain an identical current reading as measured with the external AC ammeter. With the correct current displayed, press the ENTER push-button to accept the correction factor number. Record the correction factor number on the programming sheet for future reference. Repeat for each phase.

Note: When the span calibration setting is complete, re-confirm the zero calibration points. If the zero calibration setpoint needs further adjustment, the span calibration point must also be re-calibrated.

Battery Voltage Calibration

To accurately calibrate the MEC 2 battery voltage sensor, an external test DC voltmeter is required, with an accuracy of 0.5% or better.

```
BAT VOLTS  SPAN
     99          24.6V
```

Displays the type of calibration function (SPAN).
Displays the calibration correction factor number (0-255) used to obtain the correct voltage reading.
Displays the actual battery voltage measurement that will be the same value as shown on the MEC 2 display menu. This voltage reading may be calibrated higher or lower by changing the correction factor.

SPAN Calibration

Energize the battery supply voltage to the controller and connect the external test DC voltmeter to the battery terminals, B+ and B-. In the programming mode, scroll to the battery span calibration point. Use the INCREMENT or DECREMENT push-buttons to adjust the correction factor number while observing the displayed battery voltage level on the MEC 2. Adjust the correction factor number to obtain an identical voltage reading as measured with the external DC voltmeter. With the correct voltage displayed, press the ENTER push-button to accept the correction factor number. Record the correction factor number on the programming sheet for future reference.

Engine Temperature & Oil Pressure Calibration

To accurately calibrate the controller's temperature sensor, an external temporary engine mounted temperature gauge is required. The external temperature gauge should be connected as close as possible to the temperature sender.

To accurately calibrate the controller's pressure sensor, an external temporary engine mounted pressure gauge is required. The external pressure gauge should be connected as close as possible to the pressure sender.

```
ENGINE  TEMP
  127     95°C
```

Displays the type of calibration function.
Displays the calibration correction factor number (0-255) used to obtain the correct Temperature or Pressure reading.
Displays the actual temperature or pressure measurement shown on the display menus.
This reading may be calibrated higher or lower by changing the correction factor number.

Engine Temperature The engine temperature analog circuit must be calibrated with the engine temperature sender mounted on the engine. Connect a temporary engine mounted temperature gauge of suitable accuracy and start the engine. After the engine reaches normal operating temperature, enter the programming mode and scroll to the "Engine Temperature Offset" calibration point. Use the INCREMENT or DECREMENT push-buttons to adjust the correction factor number while observing the displayed temperature. Adjust the correction factor number to obtain the identical temperature reading as measured with the external temperature gauge. With the correct temperature displayed, press the "Enter" push-button to accept the correction factor number. Record the correction factor on the programming sheet for future reference.

Oil Pressure Connect a temporary engine mounted pressure gauge of suitable accuracy and start the engine. After the engine reaches normal operating pressure and temperature, enter the programming mode and scroll to the "Engine Pressure Offset" calibration point. Use the INCREMENT or DECREMENT push-buttons to adjust the correction factor number while observing the displayed pressure. Adjust the correction factor number to obtain the identical pressure reading as measured with the external pressure gauge. With the correct pressure displayed, press the "Enter" push-button to accept the correction factor. Record the correction factor on the programming sheet for future reference.

Engine Temperature		Sender Resistance	Oil Pressure		Sender Resistance
°F	°C	Ohms	KPA	PSI	Ohms
392	200	20	1034	150	38
374	190	24	965	140	42
356	180	28	896	130	48
338	170	33	827	120	54
320	160	39	758	110	62
302	150	46	689	100	70
284	140	55	621	90	79
266	130	65	552	80	89
248	120	76	483	70	101
230	110	90	414	60	114
212	100	106	345	50	127
194	90	147	276	40	142
176	80	197	207	30	160
150	70	290	138	20	183
140	60	426	69	10	206
122	50	622			
104	40	952			
86	30	1486			
68	20	2322			
50	10	3644			
32	0	6284			

Note: Sender resistance data shown are for Oil Pressure Sender p/n-003654 (Thompson p/n), Manufacturer- Datcon, p/n 102227. Datcon Sender must be used with MEC software version 1.81 or greater (previous software versions cannot be used).

Figure 4-16 Configuration Data Sheet

WORK ORDER #:	REV:	REV DATE:
INITIATED BY:	CUSTOMER:	DEFAULT PROGRAM:
DATE:	PROJECT NAME:	TPS VER:
NOTES:		

ENGINE/GEN SYSTEM INPUTS

SYSTEM AC VOLTS:	PHASES:	FREQUENCY:	DC VOLTAGE:

DIGITAL DISPLAY FEATURES

☐ AC VOLTAGE	☐ AC CURRENT	☐ BATTERY VOLTAGE
☐ ENGINE TEMPERATURE	☐ KVA	☐ TACHOMETER
☐ OIL PRESSURE	☐ FREQUENCY	☐ HOURMETER

DIGITAL FAULT CIRCUITS (15)		ANALOG FAULT CIRCUITS	
FAULT NAME	**INPUT NAME**	**FAULT NAME**	**INPUT NAME**
Overcrank Shutdown	Internal	Overspeed Shutdown	Mag-Pickup
Switch Not in Auto Alarm	Internal	Loss of Speed Sig. Shtdn	Mag-Pickup
Emergency Stop	Internal/ext	Undervoltage Shutdown	AC Voltage
	Ext Dig Input #1	Under Frequency Alarm	AC Freq
	Ext Dig Input #2	Weak Battery Alarm	DC Volts
	Ext Dig Input #3	Low Battery Voltage Alarm	DC Volts
	Ext Dig Input #4	High Battery Voltage Alarm	DC Volts
		Low Engine Temp. Alarm	Temp. Sender
		High Engine Temp #1 Alm	Temp. Sender
		High Engine Temp #2 Shdn	Temp. Sender
		Low Oil Pressure #1 Alarm	Press. Sender
		Low Oil Pressure #2 Shutdown	Press. Sender
	STANDARD OUTPUT CONTACTS		
	OUTPUT NAME		**OUTPUT TYPE**
	Run (Fuel)		Form A
	Crank		Form A

PROGRAMMABLE CONTACTS

OUTPUT NAME	OUTPUT TYPE
ATS Test (Std Default) or Custom ____________________	Programmable #1 – Form C
Common Alarm (Std Default) or Custom ____________________	Programmable #2 – Form C
Common Shutdown (Std Default) or Custom ____________________	Programmable #3 – Form C
Engine Running (Std Default) or Custom ____________________	Programmable #4 – Form C
EPS Supplying Load/Engine Running (Std Default) or Custom ____________	Programmable #5 – Form A/B (EAP 110/MEC 2 Exp –Group 1 Only)
Disabled (Std Default) or Custom ____________________	Programmable #6 – Form A/B] (EAP 110/MEC 2 Exp –Group 2 Only)

Figure 4-17 Main Menu Loop Parameters

Parameter	Setting	Range
System Voltage (Line To Line)	XXXXX VAC	120-15000V AC
System Frequency	50Hz/60Hz	Toggle Between 50/60 Hz
System Phases	1 Phase/3 Phase	Toggle Between 1 & 3 Phase
	Neutral Connected	Toggle Between Yes/No
	Voltage Sensing	Voltage Sensing Pt Ratio
	Ratio XXX	Enter Number 1-208 (1=Direct)
	Current Sensing	Current Sensing Ct Ratio
	Ratio XXX	Enter Number 1-999 (1=Direct)
Temperature Scale	Deg C/Deg F	Toggle Between Deg C/Deg F
Pressure Scale	PSI/KPA	Toggle Between Psi/Kpa
Start Delay	XXX Seconds	0-999 Seconds
Crank Time	XX Seconds	0-99 Seconds
Rest Time	XX Seconds	0-99 Seconds
Starter Re-engage Delay	XX Seconds	0-99 Seconds 0=Disabled
Number Of Cranks	XX Cranks	0-99 Times 0=Continuous
Bypass Delay	XX Seconds	0-99 Seconds
Cool down Delay	XX Seconds	0-9999 Seconds
Nominal RPM	XXXX RPM	0-4000RPM
Flywheel Teeth (Engine Speed Sensing, Magnetic Pick Up	XXX Teeth	0-999 Teeth
Crank Disconnect	XX %	0-100%
Overspeed	XX %	100-150%
Overspeed Transient	X.X Seconds	0.0-9.9 Seconds
Run Output	Fail Safe Yes/No	Toggle Between Yes/No
Loss Of Speed Signal	Shutdown Alarm/Shutdown	Toggle Between Alarm/Shutdown
Common Fail For	Not In Auto Yes/No	Toggle Between Yes/No
Horn For Not In Auto		Toggle Between Yes/No
Prog Output #1		Common Fail (Factory setting)
Prog Output #2		Common Fail (Factory setting)
Prog Output #3		Common Fail (Factory setting)
Prog Output #4		Common Fail (Factory setting)
Prog Output #5		Common Fail (Factory setting)
Prog Output #6		Common Fail (Factory setting)
Warm-up Delay		0-99 Seconds
Neutral Delay		0-99 Seconds
Return Delay		0-999 Seconds
Reset Run Hours		Access by Master Password Only
Yes/No		Toggle Between Yes/No

Figure 4-18 Analog Fault Menu Loop Parameters

Fault Name	Input Analog Type	Fault E=Enable D=Disable	Setpoint Level (Pick-up)	Setpoint Level (Drop-out)	Action S=Shutdown A=Alarm	Alarm Latch Y=Yes N=No	Bypass On Start Y=Yes N=No	Transient Delay (Sec)
Under Voltage	AC Voltage	E*			S	Y	Y*	5.0
Under Frequency	AC Frequency	E*			S	Y	Y*	5.0
Weak Battery	DC Voltage	E*	18.0	N/A	A*	Y	N*	3.0
Low Battery Voltage	DC Voltage	E*	25.6	N/A	A*	N	N*	120.0
High Battery Voltage	DC Voltage	E*	30.4	N/A	A*	N	N*	10.0
Low Engine Temp	Temp Sender	E*	95 °F	N/A	A*	Y	N*	5.0
High ENG Temp #1 Alarm	Temp Sender	E*	198 °F	N/A	A	Y	Y	2.0
High ENG Temp #2 Shutdown	Temp Sender	E*	206 °F	N/A	S	Y	Y	2.0
Low Oil Press #1 Alarm	Press Sender	E*	30PSI	N/A	A	Y	Y*	2.0
Low Oil Press #2 Shutdown	Press Sender	E*	20PSI	N/A	S	Y	Y*	2.0

* Indicates parameter is non-programmable.

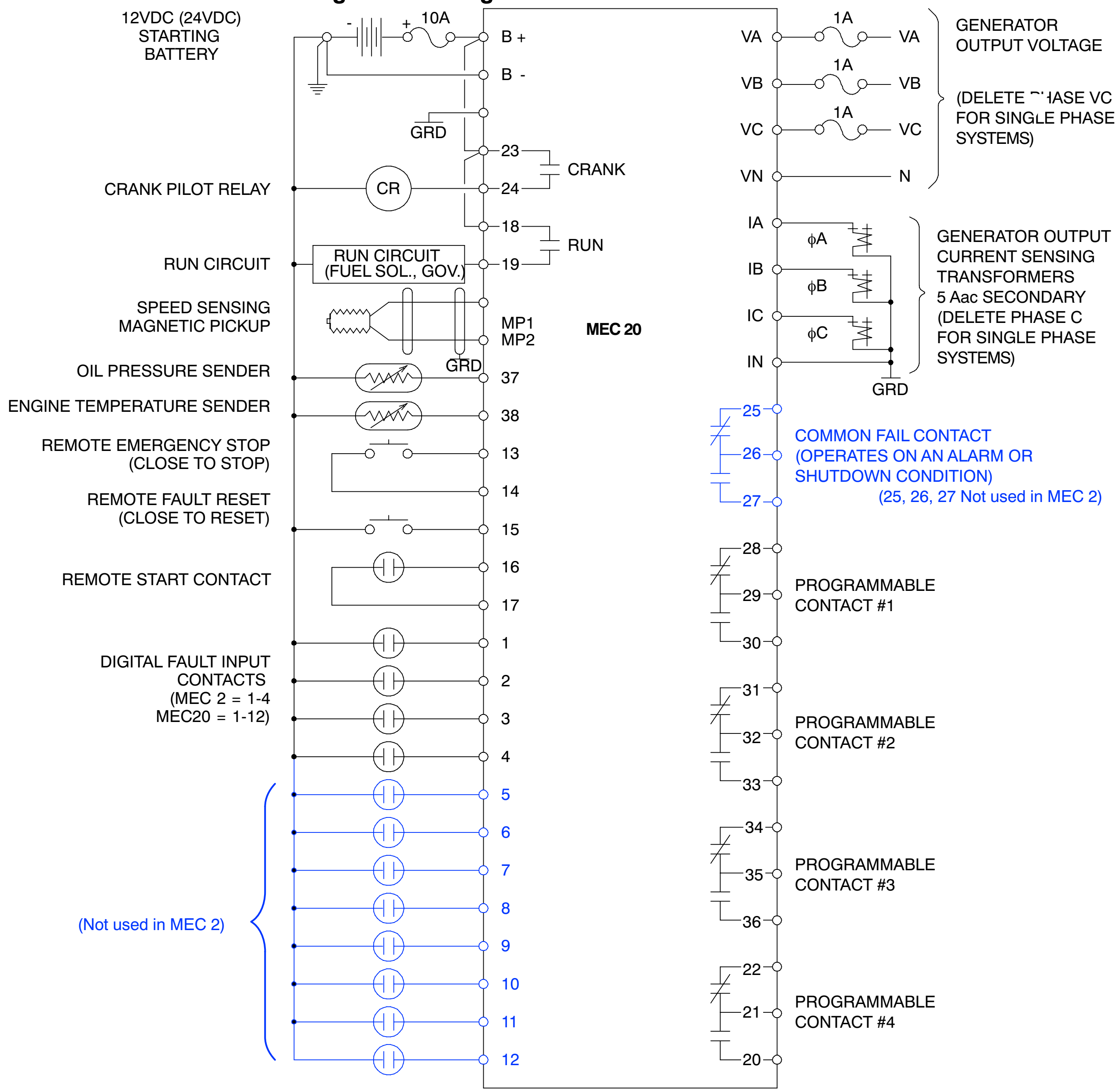
Figure 4-19 Digital Fault Menu Loop Parameters

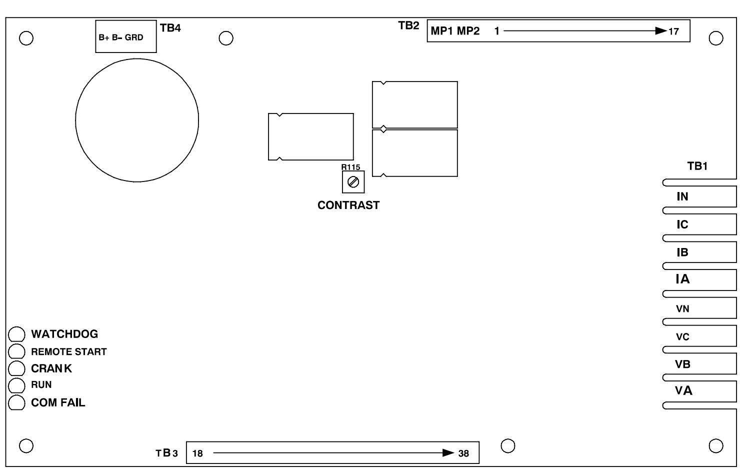
Fault Name	Input #	Action S=Shutdown A=Alarm	Alarm Latch Y=Yes N=No	Polarity O=Open C=Close	Bypass On Start Y=Yes N=No	Transient Delay (Sec)
Low Oil Pressure	1	S	-	O	Y	0.5
High ENG TEMP	2	S	-	O	Y	1.0
Batt Chgr Input Fail	3	A	Y	C	N	30.0
Low Fuel Level	4	A	N	C	N	0.1

Figure 4-20 Calibration Menu Loop Parameters

Parameter	Setting	
Volts A-B	Zero XXX	XXXVAC
Volts A-B	Span XXX	XXXVAC
Volts B-C	Zero XXX	XXXVAC
Volts B-C	Span XXX	XXXVAC
Volts C-A	Zero XXX	XXXVAC
Volts C-A	Span XXX	XXXVAC
Volts A-N	Zero XXX	XXXVAC
Volts A-N	Zero XXX	XXXVAC
Volts B-N	Zero XXX	XXXVAC
Volts B-N	Zero XXX	XXXVAC
Volts C-N	Zero XXX	XXXVAC
Volts C-N	Zero XXX	XXXVAC
Current A	Zero XXX	XXXAAC
Current A	Span XXX	XXXAAC
Current B	Zero XXX	XXXAAC
Current B	Span XXX	XXXAAC
Current C	Zero XXX	XXXAAC
Current C	Span XXX	XXXAAC
Battery Voltage	Span XXX	XX.X VDC
Engine Temperature	XXX	XXX C/F
Oil Pressure	XXX	XXXX PSI/KPA

Figure 4-21 Engine Control Connections





Maintenance

This manual contains only very minimal engine maintenance instructions. Refer to the engine manufacturer's owner's manual for specific engine maintenance instructions for your generator set. Any maintenance instructions or recommendations in the engine owner's manual take precedence over any of the following general recommendations.

General:

1. Inspect the fuel system for leaks. Replace all defective components immediately.
2. Inspect and replace any fuel line that shows signs of deterioration.
3. Inspect all the fuel clamps to ensure they are tight.
4. Inspect and clean the battery posts and the associated battery cable terminals.
5. Inspect the external wire cables and connectors used with the generator set for cuts, fraying, or loose connections. Repair or replace any problems prior to using the unit.

Engine:

1. Clean and/or replace any fuel, oil, and/or air filters per the engine manufacturers' guidelines.
2. Check oil level regularly; at least every 5 to 8 operating hours. Maintain the proper oil level.
3. Change the oil as is recommended in the engine manufacturer's owner's manual.
4. Replace the spark plug(s) as is recommended by the engine manufacturer.
5. Clean the cooling fins on the engine to keep the engine's heat dissipation potential at it's maximum.
6. Inspect and clean all governor and carburetor linkages so they operate properly.
7. Inspect the recoil starting rope for any damage and replace it if necessary (if applicable).
8. Clean the trash screen around the recoil starter or other cooling air intake.

Alternator: (also called Generator End)

This generator set must be run at its proper speed to obtain the correct electrical power at its output. All engines have a tendency to slow down when a load is applied to it. The engine governor is designed to hold the operating speed as nearly constant as possible. When the electrical load is increased, the engine is more heavily loaded and engine speed drops slightly. This slight decrease in engine speed results in a slight decrease in generator voltage and frequency output. This voltage and frequency variation has no appreciable effect in the operation of motors, lights, and most appliances and tools. However, timing devices and clocks will not keep perfect time when used on this generator.

1. Clean the generator set and remove any and all dust, dirt, or other foreign material.
2. Inspect and clean the cooling air intake and exhaust louvers of the generator end. Make sure they are clean. Remove dirt or any buildup that may restrict the cooling air flow.
3. Clean the generator set and its components with a damp cloth or sponge.
   Never use a water hose or pressure washer as this may damage electrical components.
4. Inspect and replace any control panel components that are broken or not working properly (receptacles, circuit breakers, switches, etc.)

Problems and Solutions

Some of the more common problems are listed in Table 5-1. This information is intended to be a check or verification that simple causes can be located and fixed. It is not an exhaustive “how to” for all types of problems. Procedures that require in depth knowledge or skills (like flashing the field) should be referred to a qualified generator service center.

Table 5-1 General Troubleshooting Guide

Problem	Possible Cause	Remedy
Engine cranks but will not start	No fuel. Low Oil Level Restricted air flow. No spark. No engine speed during crank	Check that fuel valves are ON. Check fuel level in fuel tank. Low Oil Pressure Sutdown activated. Replensih oil to full. Check/replace air filter. Check/replace spark plug(s). Check that engine switch is in Start position. The magnetic pickup must be correctly adjusted and operating.
Engine will not crank (electric start)	Dead battery. Emergency Stop LED is ON	Remove battery and trickle charge or replace with new battery. Never Jump Start. Reset controller after an Emergency Stop.
Engine starts but will not run smoothly	Fuel or ignition problem	Refer to engine manual.
Engine overheats	Excessive load Debris or dirt buildup on engine	Remove one or more electrical loads. Remove debris. Clean engine surfaces to allow cooling.
No output voltage	Ciruit Breaker tripped or failed. Internal failure of Alternator	Reset circuit breaker or replace if required. Return to factory for repair.
Output voltage varies	Irregular speed (fixed speed mode) Fluctuating speed (fixed speed mode) Loose terminal or load connections	Check engine for malfunction or load for fluctuation Stabilize load. The addition of a lamp load (resistance load) may compensate partially for load changes caused by intermittent motor operation. Do not overload. Verify all connections and terminal tighness.
Low output voltage	Low engine speed Excessive load High resistance connections - connections will be warm or hot Internal failure of Alternator Low power factor	Verify engine RPM. Check engine for malfunction or system for overload. Reduce load. Verify all connections and terminal tighness. Return to factory for repair. Reduce inductive (motor) load. Some AC motors use about the same current regardless of load. Do not use motors of greater horsepower rating than is necessary to move the mechanical load.
High output voltage	Excessive speed (fixed speed mode)	Check engine for malfunction. Verify engine RPM.
Electrical shock when frame is touched	Static charge. Grounded armature or field coil.	Ground generator frame at local reference ground (see Section 3). Return to factory for repair
Mechanical noise	Internal failure of Alternator Loose or misaligned coupling	Return to factory for repair Tighten; align coupling and alternator shaft to engine shaft.

Table 5-2 Troubleshooting Guide (Digital Controller Only)

Problem	Possible Cause	Remedy
Controller does not power up even with correct DC power applied	Wiring Mistake	Check that there are no wiring errors/short circuits connected to the controller.
	Overload Condition	The MEC 20 contains an electronic fuse that trips when an overload condition exists and does not reset until the supply voltage is removed and reapplied after the overload condition is corrected.
LCD Display cannot be viewed	Microprocessor failure	Check that the controller's microprocessor is running by observing a red flashing "watchdog" LED on the rear of the PCB. Replace controller if failed.
	Improper Supply Voltage	Check DC supply voltage at terminals B+ & B- (10-30VDC).
	Improper contrast adjustment	Adjust LCD contrast potentiometer (R115) on rear of PCB for best display.
Controller cannot be "Reset"	Engine not stopped	Verify the engine is at a complete stop before trying to reset.
	Controller not in OFF mode	Set the controller to the OFF mode before trying to reset.
No "RUN" output signal	"Shutdown Faults" not reset	All shutdown faults must be reset (red shutdown LED must be off).
	Engine speed not detected at cranking	Engine speed signal must be detected (speed signal green LED on) during cranking if the "run-output fail safe" feature is enabled. Verify correct magnetic pickup signal at cranking (2.0VAC min. during cranking).
	Run Contact not closing (terminals #18 & #19)	Check that the RUN output LED (on the rear of the PCB) is on. If yes, verify relay contact operation on terminals #18 & #19. Replace controller if failed.
Overspeed shutdown occurs at normal speed	Controller programmed values are wrong or controller has failed.	Verify the controller programmed values are correct for the number of flywheel teeth, nominal RPM, and overspeed setpoint percentage. Replace controller if failed.
Voltage or current metering is incorrect	Controller programmed values are wrong	Verify the controller programmed values are correct for the voltage sensing PT ratio and/or current sensing CT ratio.
	Ground is missing	Verify that the battery supply DC negative conductor is properly grounded to the engine block (i.e. to a common ground point).
	Analog input needs to be calibrated	Verify that the controller's analog input is properly calibrated.
	Voltage sensing wiring mistake	Verify the voltage sensing wiring connection to the MEC 20 matches power distribution type. Note: standard direct voltage connection requires that the generators neutral is solidly grounded.
Engine temperature or oil pressure display is incorrect	Analog input needs to be calibrated	Verify that the controller's analog input is properly calibrated.
	Failed engine sensor	Verify engine sensors. Note: engine sensors must be factory supplied units only.
	Ground is missing	Verify that the battery supply DC negative conductor is properly grounded to the engine block (i.e. to a common ground point).
Engine temperature or oil pressure displays 9999 **OR** Engine alarms are ON for high engine temperature or low oil pressure when engine is operating properly	Sending unit is disconnected (open circuit)	Verify the sending units wiring to controller terminals #37 & #38 (i.e. wiring is not open or shorted).
	Defective sending unit	Verify the engine mounted senders have correct resistance values for corresponding input temperature or pressure.
	Wrong Temp or pressure calibration	Verify calibration.
Keypad Buttons (switches) do not operate.	Keypad not connected to controller	Verify the interconnecting ribbon cable between the lexan faceplate and main printed circuit board is correctly connected. Replace controller if failed.

Note: See Engine Controller manual for additional information.

Table 5-3 Troubleshooting Guide (Analog Controller Only)

Problem	Possible Cause	Remedy
Controller cannot be "Reset"	Engine not stopped Controller not in OFF mode	Verify the engine is at a complete stop before trying to reset. Set the controller to the OFF mode before trying to reset.
Engine alarms are ON for high engine temperature or low oil pressure when engine is operating properly	Sending unit is disconnected (open circuit) Defective sending unit	Verify the sending units wiring to controller terminals is not open or shorted. Verify the engine mounted senders have correct resistance values for corresponding input temperature or pressure.
Overspeed shutdown occurs at normal speed	Controller has failed or input from Magnetic pickup is incorrect.	Verify the adjustments. Replace controller if failed.

Service Service for your generator can be obtained from to a qualified generator service center. Please have the following information available and ready:

The model number and serial number of the generator set.

A complete and accurate description of the problem.

Parts Parts for your generator can be obtained from to a qualified generator service center. Please have the following information available and ready:

The model number and serial number of the generator set.

A complete and accurate description of the part (part number if known).

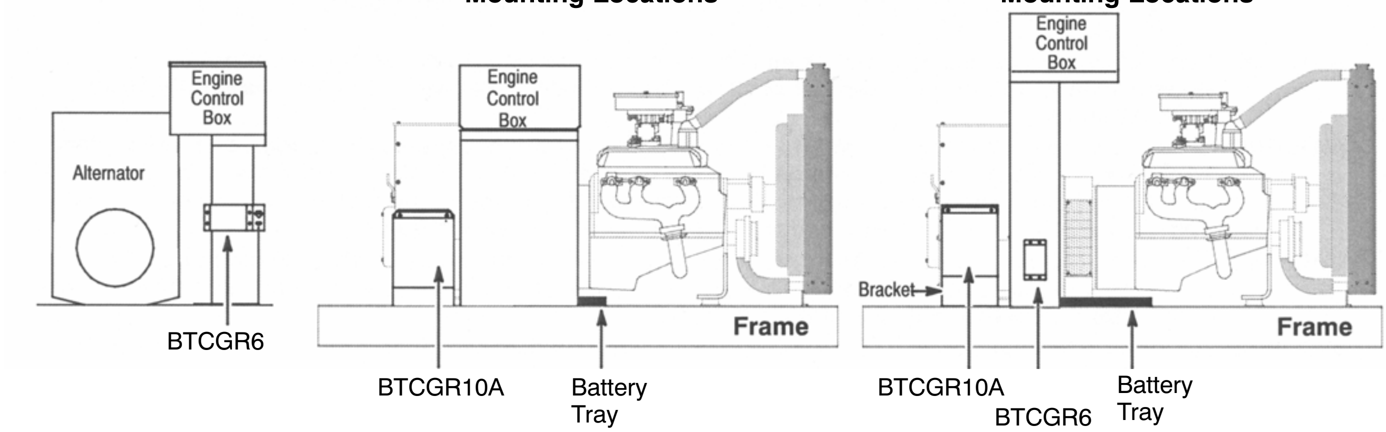
Note: Engine parts can usually be obtained from a local distributor by using the information in the engine manufacturer's owner's manual.

Battery Charger

BTCGR6 Battery Charger - 12 Volt / 6 Amp Float. Includes 6 ft power cord with grounding plug for AC input power and 4 ft power cord with ring terminals for DC output. UL Listed.
BTCGR10A Battery Charger - 12 Volt /10 Amp Float. Includes terminal strip for AC input power and DC output.UL Listed.

Figure A-1 Recommended Mounting Locations

GLC30-45 Battery Charger Mounting Locations **GLC60-105 Battery Charger Mounting Locations**



Installation Considerations:

Shore power must be available (120VAC or 240VAC) to power the battery charger and other components that may be installed). Shore power outlets or wiring must be located close to Battery Charger.

BTCGR6 Charger (refer to charger manual for specific details)

1. Mount charger, refer to Figure A-1 to determine suggested location.
2. Connect charger negative wire to battery ”-” negative terminal.
3. Connect charger positive wire (with fuse) to battery ”+” positive terminal.
4. Connect charger AC power cord to shore power outlet.

BTCGR10A Charger (refer to charger manual for specific details)

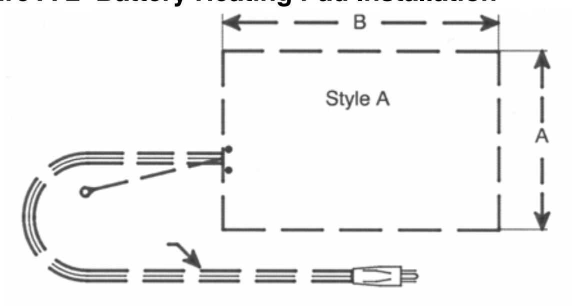
1. Mount charger, refer to Figure A-1 to determine suggested location.
2. Connect charger negative wire (Black) to battery ”-” negative terminal.
3. Connect charger positive wire (Red) to battery”+” positive terminal.
4. Connect charger AC power cord to shore power outlet.

Battery Heaters Battery Heater (BTHTR81) - 120 Volt / 80 Watt. Includes 6 ft power cord.

Installation Considerations:

Shore power must be available (120VAC or 240VAC) to power the battery heater and other components that may be installed). Shore power outlets or wiring must be located close to battery heater.

Figure A-2 Battery Heating Pad Installation



BTHTR81 Heater

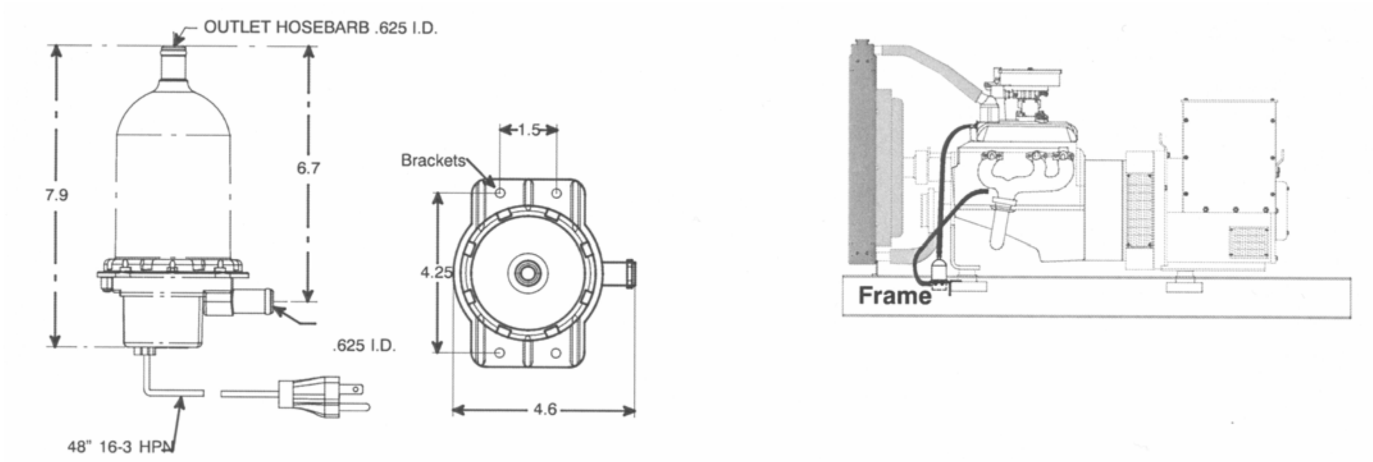
1. Carefully disconnect the Negative battery terminal from the battery.
2. Carefully disconnect the Positive battery terminal from the battery.
3. Remove battery hold down bracket.
4. Remove battery.
5. Install Heating Pad in battery tray, refer to Figure A-2. The ”A” and ”B” dimesions should match the battery tray.
6. Install battery on top of Heating Pad.
7. Install battery hold down bracket.
8. Carefully install the Positive battery terminal to the battery.
9. Carefully install the Negative battery terminal to the battery.
10. Connect the AC power cord to shore power outlet.

Engine Block Heater

Installation Considerations:

Shore power must be available (120VAC or 240VAC) to power the block heater and other components that may be installed). Shore power outlets or wiring must be located close to block heater.

Figure A-3



<u>Catalog # G10A Block Heater</u> (refer to block heater manual for specific details)

1. Mount the block heater, refer to Figure A-3 to determine suggested location.
2. Connect the inlet hose to the inlet hose bib on the block heater.
3. Connect the outlet hose to the outlet hose bib on the block heater.
4. Connect the AC power cord to shore power outlet.

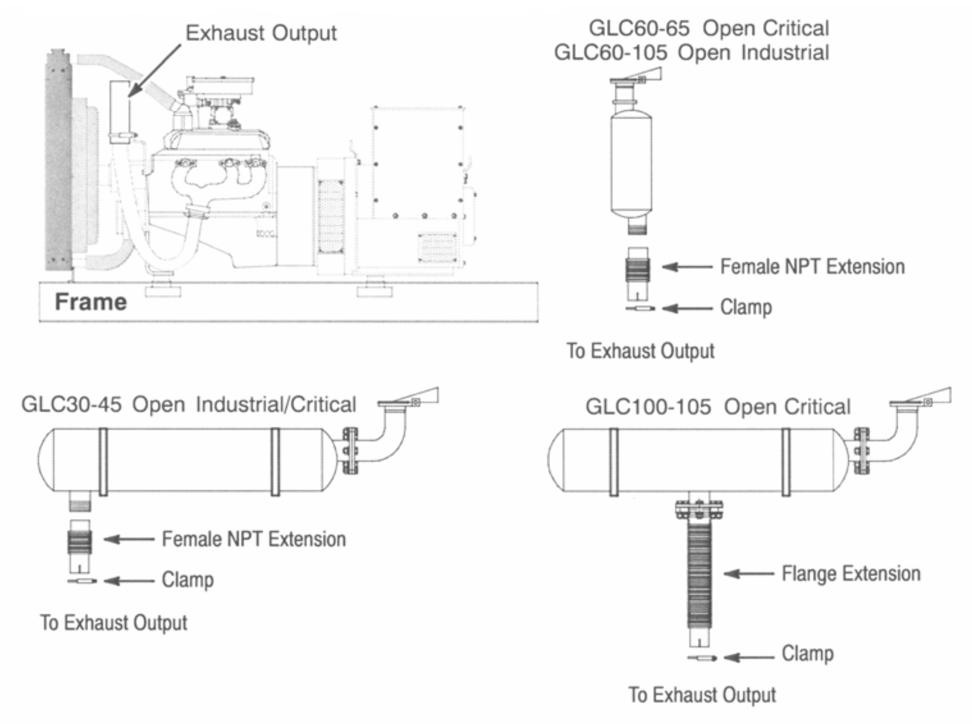
Silencers

Refer to enclosure procedure to install silencer when enclosure is present.
Industrial Silencer for Open Skid Mount Units - Provides silenced exhaust for up to 11 dBA sound attenuation. Kit includes engine adapters, flex pipe, clamps, silencer, and rain cap.
Critical Silencer for Open Skid Mount Units - Provides silenced exhaust for up to 18 dBA sound attenuation. Kit includes engine adapters, flex pipe, clamps, silencer, and rain cap.

Figure A-4

Industrial Silencer	
GLCIS-3SU-	GLC10-25
GLCIS-4SU-	GLC30-45
GLCIS-6SU-	GLC60-90
GLCIS-7SU-	GLC100-105

Critical Silencer	
GLCCS-4SU-	GLC30-45
GLCCS-6SU-	GLC60-90
GLCCS-7SU-	GLC100-105



Silencer (refer to Figure A-4 for specific details)

1. Attach the Silencer to the Exhaust Output of the engine, refer to Figure B-4.
2. Use correct size clamp to attach extension pipe to Exhaust Output pipe from engine.
3. Be sure the Extension pipe fits securely over Exhaust Output pipe so that no exhaust leaks can occur.

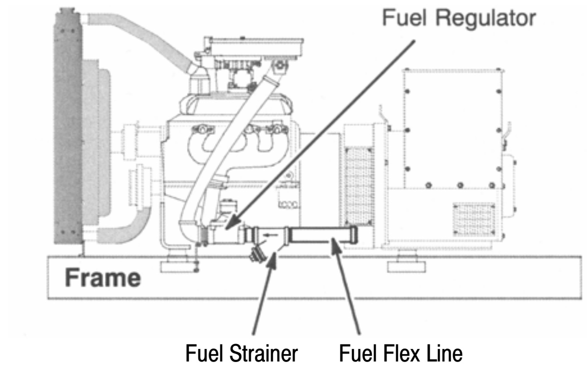
Fuel Strainers & Fuel Lines

A fuel strainer and flexible fule line can be installed at the fuel pressure regulator to make connection to the fuel main shutoff valve easier. Either 1-1/4" or 2" fittings may be specified.

Figure A-5 Fuel Strainer and Flex Fuel Line Connections

GLCFFL1 3/4" NPT Female fittings, 12" long
GLCFFL2 1 - 1/4" NPT Female fittings, 18" long
GLCFFL3 2" NPT Female fittings, 12" long

GLCFFS1- 3/4" NPT Fuel Strainer female Inlet, male outlet.
GLCFFLS3 2" NPT Fuel Strainer female Inlet, male outlet.



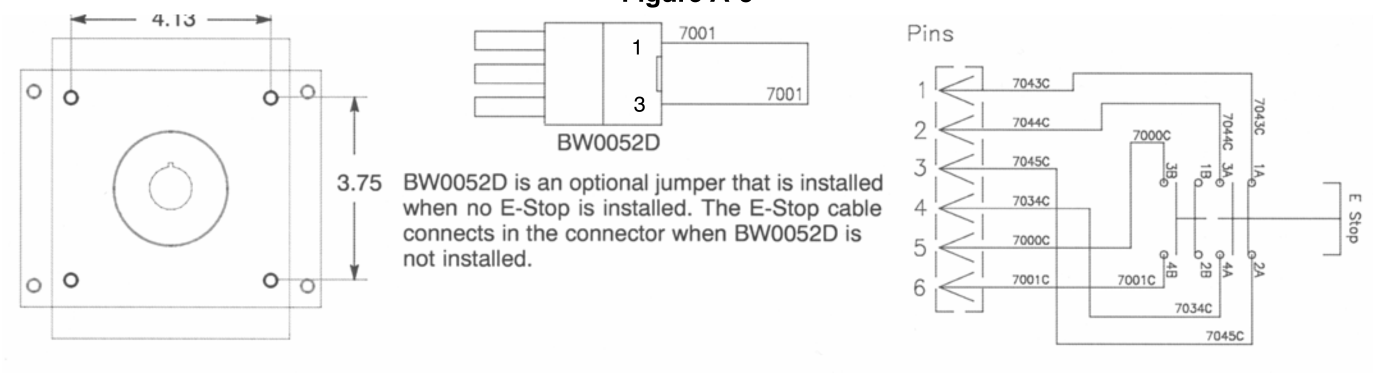
Installation: Use appropriate thread sealer as required by plumbing codes.

1. Thread Fuel strainer onto NPT close pipe nipple.
2. Install NPT close pipe nipple to Fuel strainer input.
3. Thread Flex Fuel Line onto NPT close pipe nipple.
4. Connect other end of Flex Fuel Line to site fuel supply pipe as required by plumbing codes.

E-Stop

E-Stop Switch Kit - Mounts to Baldor supplied Enclosure to provide easy access to shut down engine with the press of a button. Connects to Remote Run Terminals on genset. Must be adapted for remote mounting when used with open skid mount units.

Figure A-6



Installation:

1. Locate and drill 4 holes shown in Figure A-6.
2. Mount the E-Stop Switch box to the enclosure,
3. Install the E-Stop assembly into the E-Stop Switch box enclosure.
4. Connect the E-Stop Switch cable into the connections for BW0052D.

Remote Annuciators

Remote Annunciator - For use with MEC2 Controller. Provides remote anunciation of faults and generator status. Up to 20 individual fault conditions are remotely monitored utilizing both visual LED lights & audible alarm annunciation. Lamp test and alarm horn silence pushbuttons are provided. Each fault is individually programmable for audible horn operation and alarm labels are field configurable. Requires 12VDC 100mA power supply to operate (engine starting battery can be power supply).”

Figure A-7 MEC2 Remote Annunciator

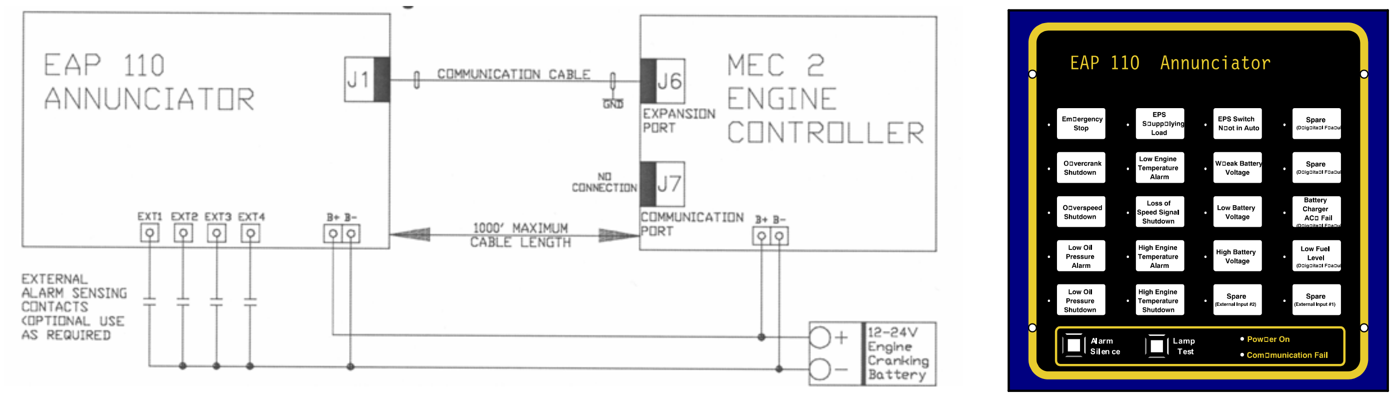
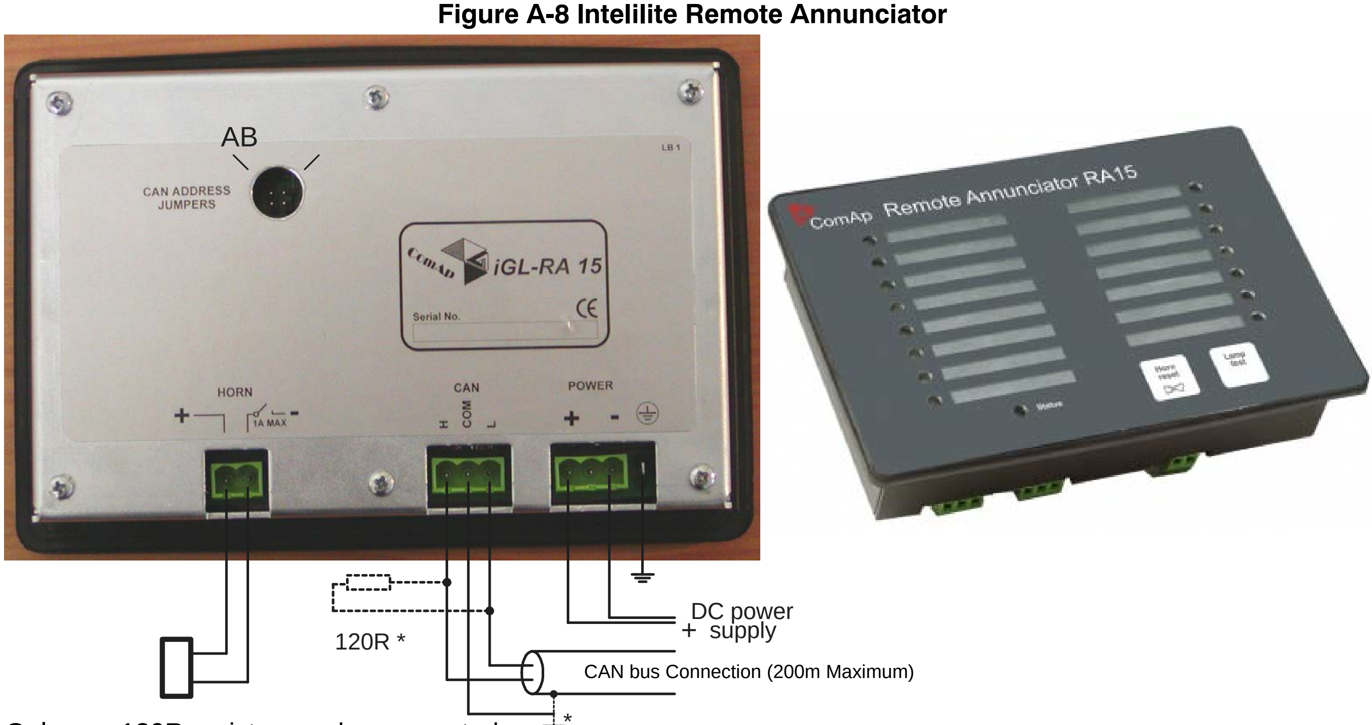


Figure A-8 Intelilite Remote Annunciator



Only one 120R resistor can be connected to the CAN bus (If it is the last device on the network (termination).

Radiator Duct Flange

Radiator Duct Flange for Open Skid Mount - Provides easy connection to air ducting to carry away hot air from engine radiator. Duct flange mounts to front of engine radiator.
Add 3” to length.

Figure A-9

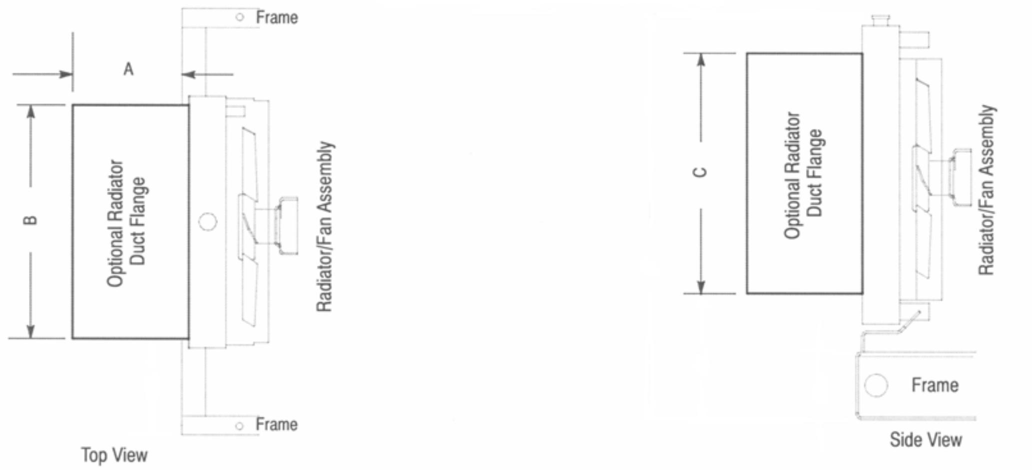


Table A-1 Mounting Dimensions

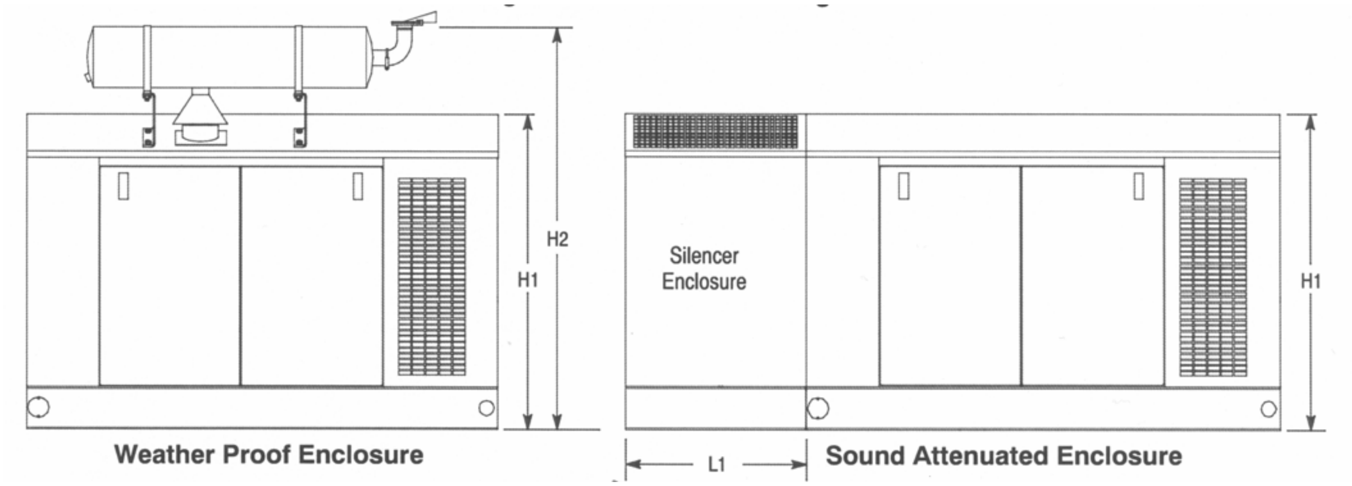
Generator	A	B	C
GLC10-25	3.00	22.00	20.00
GLC30-60	3.00	26.00	26.70
GLC80-100	3.00	26.38	29.50

Enclosures

Weather Resistant Enclosure - Heavy-duty 12 gauge hot rolled steel with welded corners and baked powder coat finish. Fasteners are zinc chromate plated and the locking latches are chrome plated on the lift off access doors. Silencer is mounted on top of reinforced pitched roof.

Sound Attenuated Enclosure - Heavy-duty 12 gauge hot rolled steel with welded corners and baked powder coat finish includes sound deadening insulation for 15 dB of attenuation. Fasteners are zinc chromate plated and the locking latches are chrome plated on the lift off access doors. Silencer is internally mounted in end-housing unit located in front of the engine radiator.

Figure A-10 Generator Lifting



GLC10-25	H1=36.0”	GLC10-25	L1=11.75”
GLC30-45	H1=52.1”, H2=66.6”	GLC30-45	L1=30”, H2=52.0”
GLC60-90	H1=64.2”, H2=76.8”	GLC60-90	L1=30”, H2=64.2”
GLC100-105	H1=64.2”, H2=87.6”	GLC100-105	L1=30”, H2=64.2”

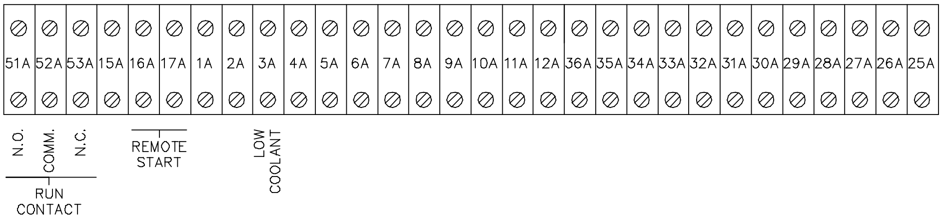
GLC Circuit Breaker & Electrical Data

Circuit Breaker Size	Qty per Phase	Min Wire Gauge	OSH Plant	Ampacity @125C
15	1	#16	1 - #8 EPDM PER PHASE	90
20	1	#16	1 - #8 EPDM PER PHASE	90
30	1	#14	1 - #8 EPDM PER PHASE	90
40	1	#12	1 - #8 EPDM PER PHASE	90
50	1	#10	1 - #8 EPDM PER PHASE	90
60	1	#8	1 - #8 EPDM PER PHASE	90
70	1	#8	1 - #8 EPDM PER PHASE	90
80	1	#6	1 - #8 EPDM PER PHASE	90
90	1	#6	1 - #6 EPDM PER PHASE	125
100	1	#6	1 - #6 EPDM PER PHASE	125
110	1	#6	1 - #6 EPDM PER PHASE	125
125	1	#4	1 - #4 EPDM PER PHASE	170
150	1	#2	1 - #4 EPDM PER PHASE	170
175	1	#2	1 - #1 EPDM PER PHASE	265
200	1	#1	1 - #1 EPDM PER PHASE	265
225	1	1/0	1 - #1 EPDM PER PHASE	265
250	1	2/0	1 - #1/0 EPDM PER PHASE	305
300	1	4/0	1 - #2/0 EPDM PER PHASE	355
350	1	4/0	1 - #3/0 EPDM PER PHASE	410
400	2	#1	1 - #4/0 EPDM PER PHASE	475
450	2	1/0	2 - #1/0 EPDM PER PHASE	610
500	2	1/0	2 - #1/0 EPDM PER PHASE	610
600	2	3/0	2 - #2/0 EPDM PER PHASE	710
700	2	4/0	2 - #3/0 EPDM PER PHASE	820
800	3	2/0	2 - #4/0 EPDM PER PHASE	950
900	3	3/0	3 - #2/0 EPDM PER PHASE	1065
1000	3	3/0	3 - #3/0 EPDM PER PHASE	1230
1200	3	250	3 - #4/0 EPDM PER PHASE	1425
1400	4	4/0	4 - #4/0 EPDM PER PHASE	1900
1600	4	250	4 - #4/0 EPDM PER PHASE	1900
2000	5	250	5 - #4/0 EPDM PER PHASE	2375
2500	6	250	6 - #4/0 EPDM PER PHASE	2850
3000	7	250	7 - #4/0 EPDM PER PHASE	3325
4000	8	300	9 - #4/0 EPDM PER PHASE	4275

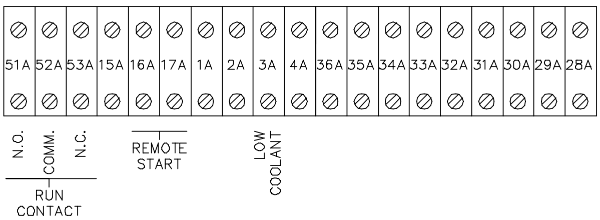
Wiring Diagrams Wiring diagrams for these generators are contained on the following pages of this appendix.

Figure B-11 Customer Interface Connection Diagram

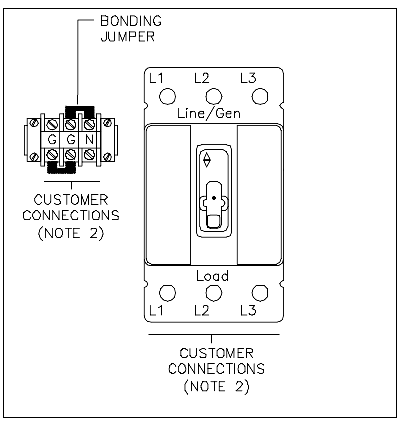
MEC20



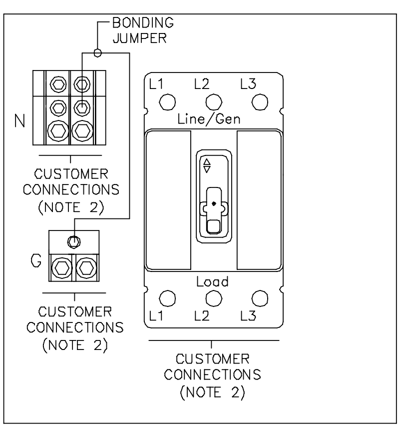
MEC2



CUSTOMER CONNECTIONS–CONTROL PANEL ENCLOSURE	
	TERMINAL STRIP ALL TERMINALS
IDENTIFICATION	AS SHOWN/MEC MANUAL
AMPACITY/SIZE	LOCAL & NATIONAL ELECTRIC CODE
TEMP RISE	75C
CONDUCTORS	CU
CONNECTOR	SCREW
CONN RANGE	#22–#10
TORQUE	7–8 in–lb (ENTIRE WIRE RANGE)
NOTES:	
1. TERMINALS 1A–36A WIRED DIRECT SAME MEC TERMINAL	
2. TERMINAL SUFFIX "A" – WIRED OUT FOR ACCESS	
3. ONE WIRE/CONNECTOR	



CUSTOMER CONNECTIONS–CIRCUIT BREAKER BOX				
	CIRCUIT BREAKER	TERMINAL STRIP		
	L1, L2, L3(NOTE1)	G NOTE 3	G	N
IDENTIFICATION	LOAD PHASE WIRES	NOTE 4	LOAD GND	LOAD N
AMPACITY/SIZE	LOCAL & NATIONAL ELECTRIC CODE			
TEMP RISE	75C	75C	75C	75C
CONDUCTORS	CU	CU	CU	CU
CONNECTOR	SCREW OR SOCKET	SCREW	SCREW	SCREW
CONN RANGE	SEE NAMEPLATE	#12 AWG–1/0 AWG	#12 AWG–1/0 AWG	#12 AWG–1/0 AWG
TORQUE	SEE NAMEPLATE	NOTE 5	NOTE 5	NOTE 5
NOTES:				
1. TERMINAL L3 NOT USED ON SINGLE PHASE UNITS				
2. ONE WIRE/CONNECTOR				
3. GROUNDING ELECTRODE TERMINAL				
4. GROUNDING ELECTRODE CONDUCTOR				
5. #10–#12 AWG 35 in–lb #8 AWG 40 in–lb #6–#4 AWG 45 in–lb #3–1/0 AWG 50 in–lb				



CUSTOMER CONNECTIONS–CIRCUIT BREAKER BOX					
	CIRCUIT BREAKER	GROUND PAD		NEUTRAL PAD	
	L1, L2, L3(NOTE1)	G NOTE 3	G	N	N
IDENTIFICATION	LOAD PHASE WIRES	NOTE 4	LOAD GND	LOAD N	LOAD N
AMPACITY/SIZE	LOCAL & NATIONAL ELECTRIC CODE				
TEMP RISE	75C	75C	75C	75C	75C
CONDUCTORS	CU	CU	CU	CU	CU
CONNECTOR	SOCKET HEAD				
CONN RANGE	SEE NAMEPLATE	#6 AWG–350 KCMIL	#6 AWG–350 KCMIL	#4 AWG–500 KCMIL	#4 AWG–500 KCMIL
TORQUE	SEE NAMEPLATE	275 in–lb	275 in–lb	375 in–lb	375 in–lb
NOTES:					
1. TERMINAL L3 NOT USED ON SINGLE PHASE UNITS					
2. ONE WIRE/CONNECTOR					
3. GROUNDING ELECTRODE TERMINAL					
4. GROUNDING ELECTRODE CONDUCTOR					

BW0440D

Figure B-12 Customer Interface (w/o Breaker) Power Connection Diagram

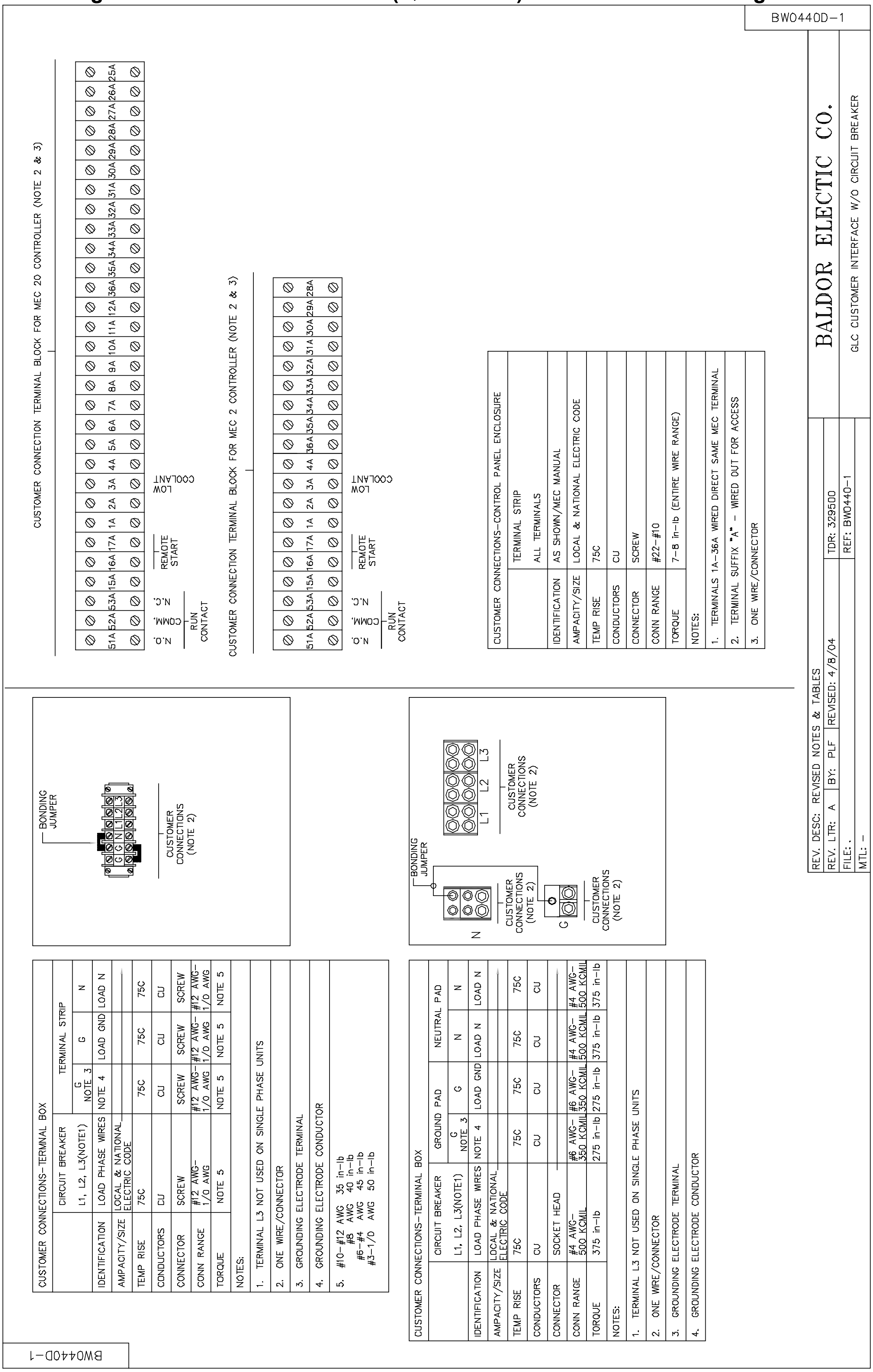


Figure B-13 Single Phase - (w/o Breaker) Connection Diagram

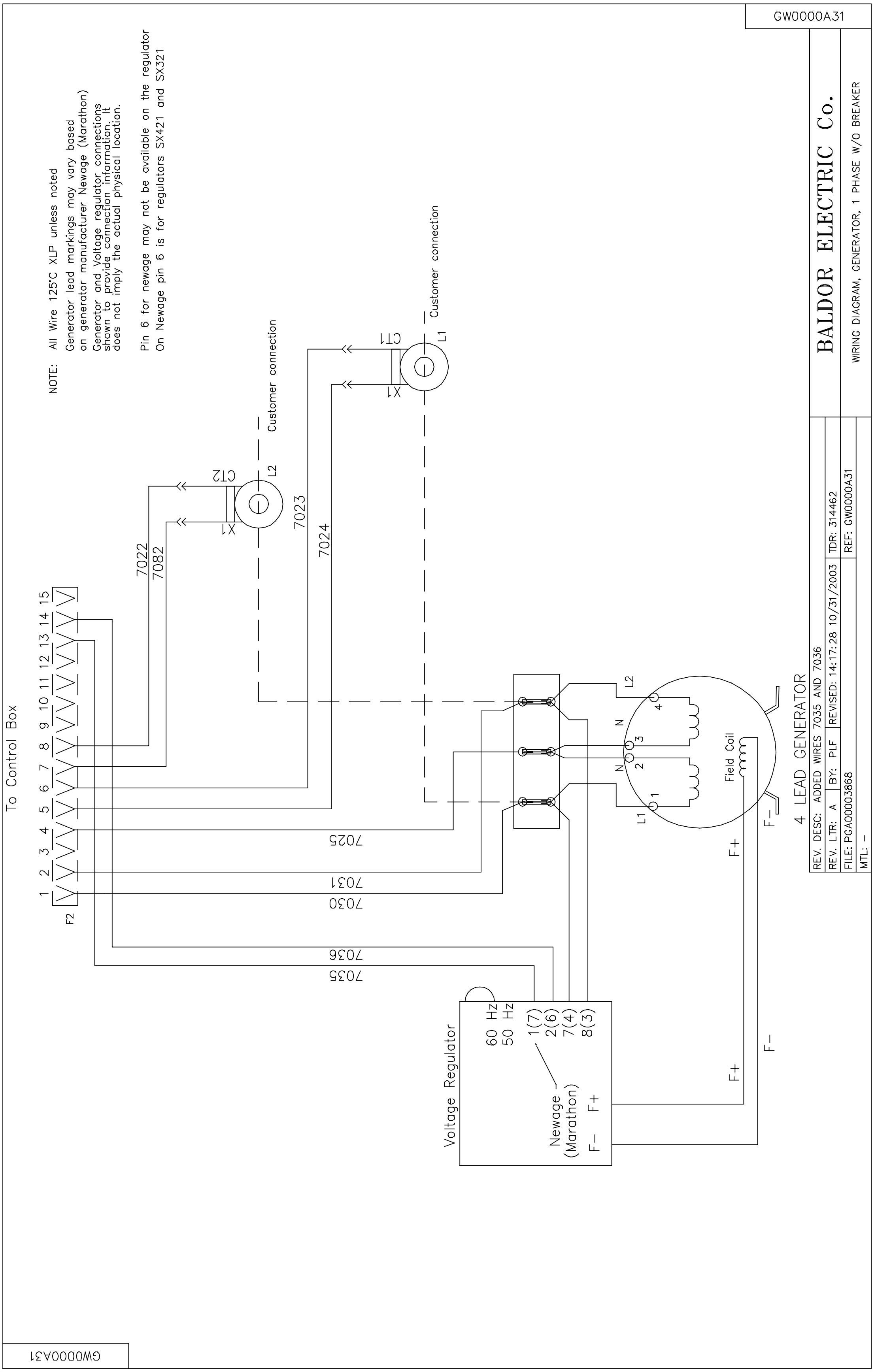


Figure B-14 Single Phase - One Breaker Connection Diagram

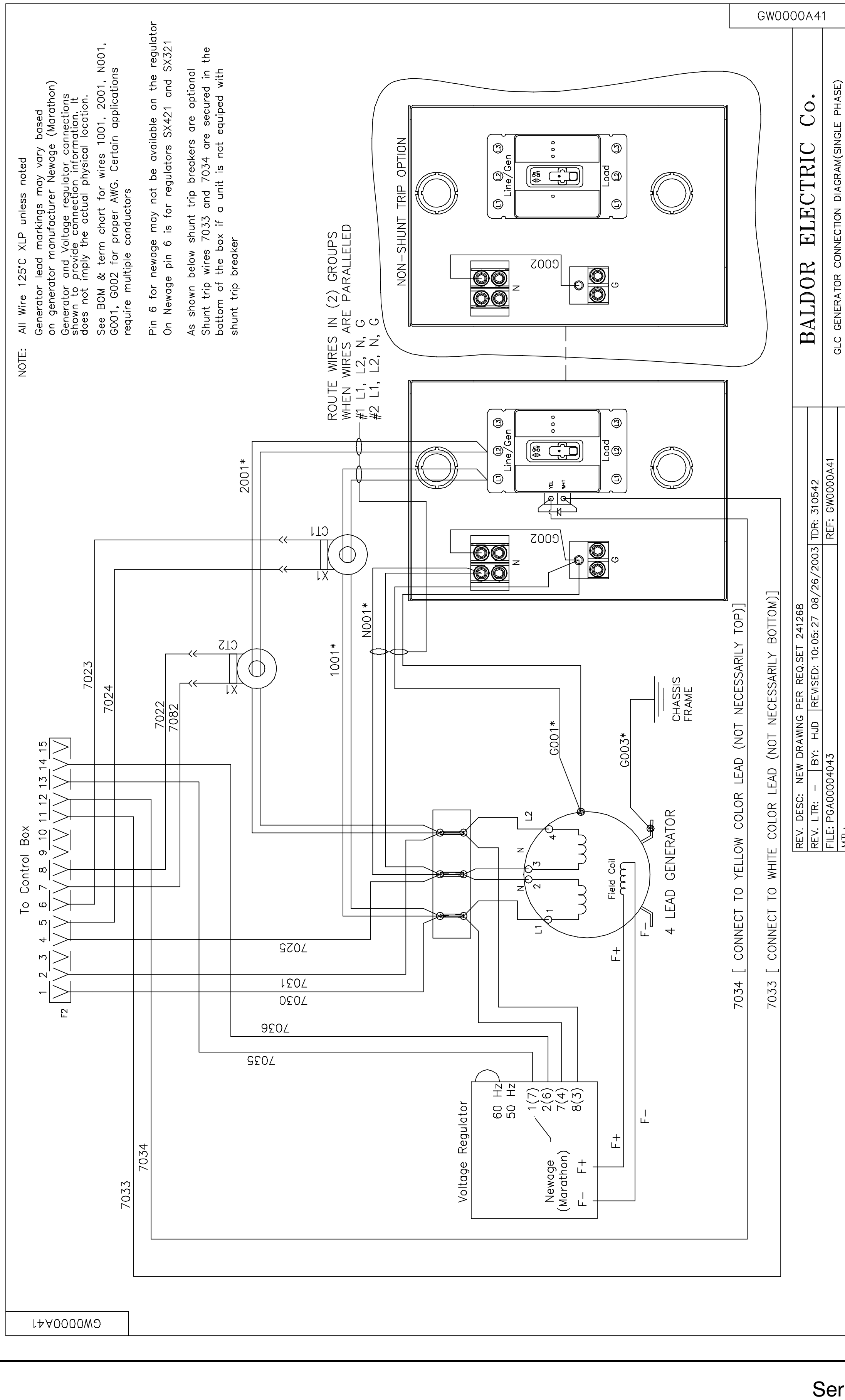


Figure B-15 Single Phase - Two Breaker Connection Diagram

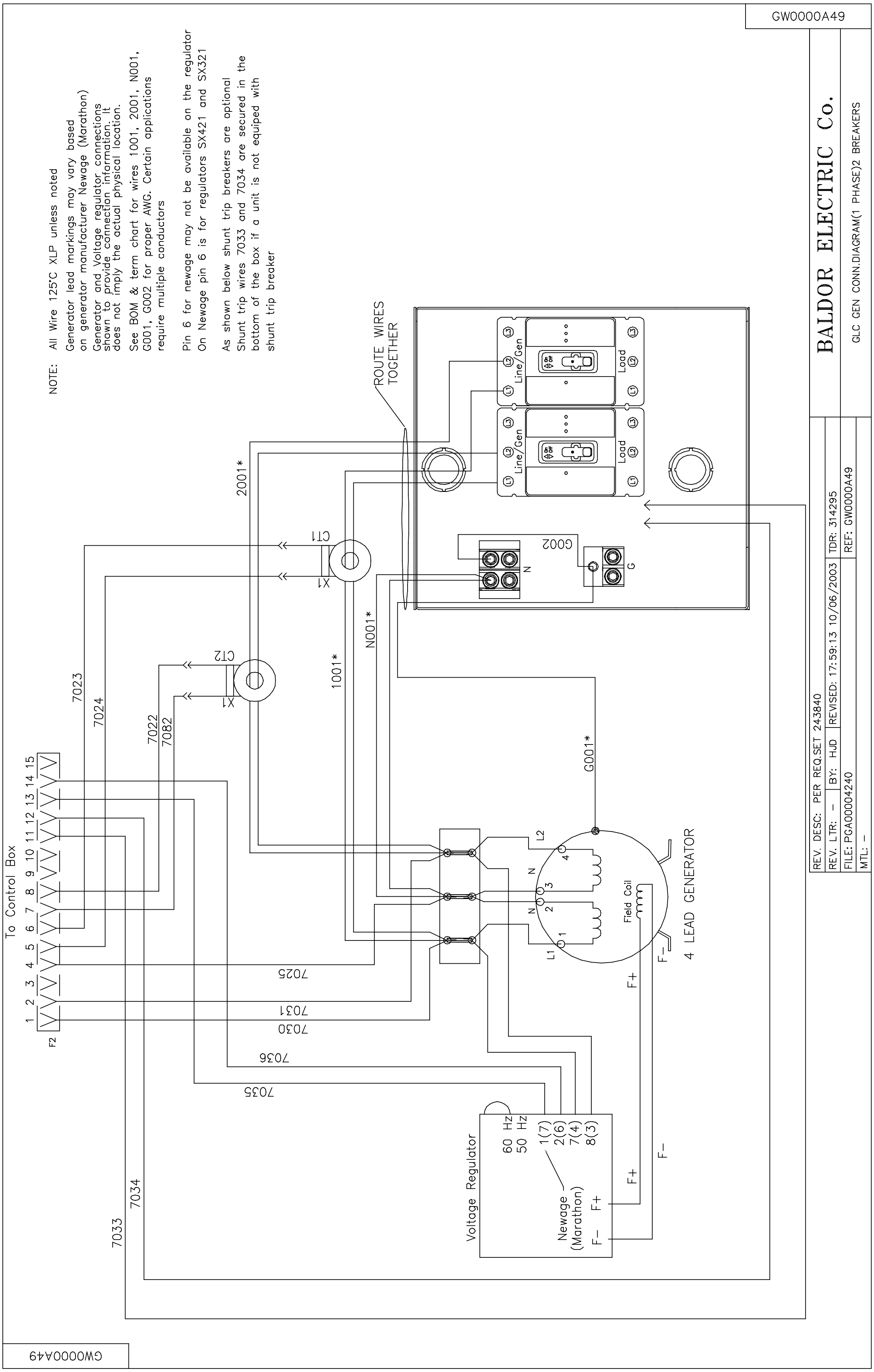


Figure B-16 Single Phase Connection Diagram (Wire 1/0 and Larger w/Breaker)

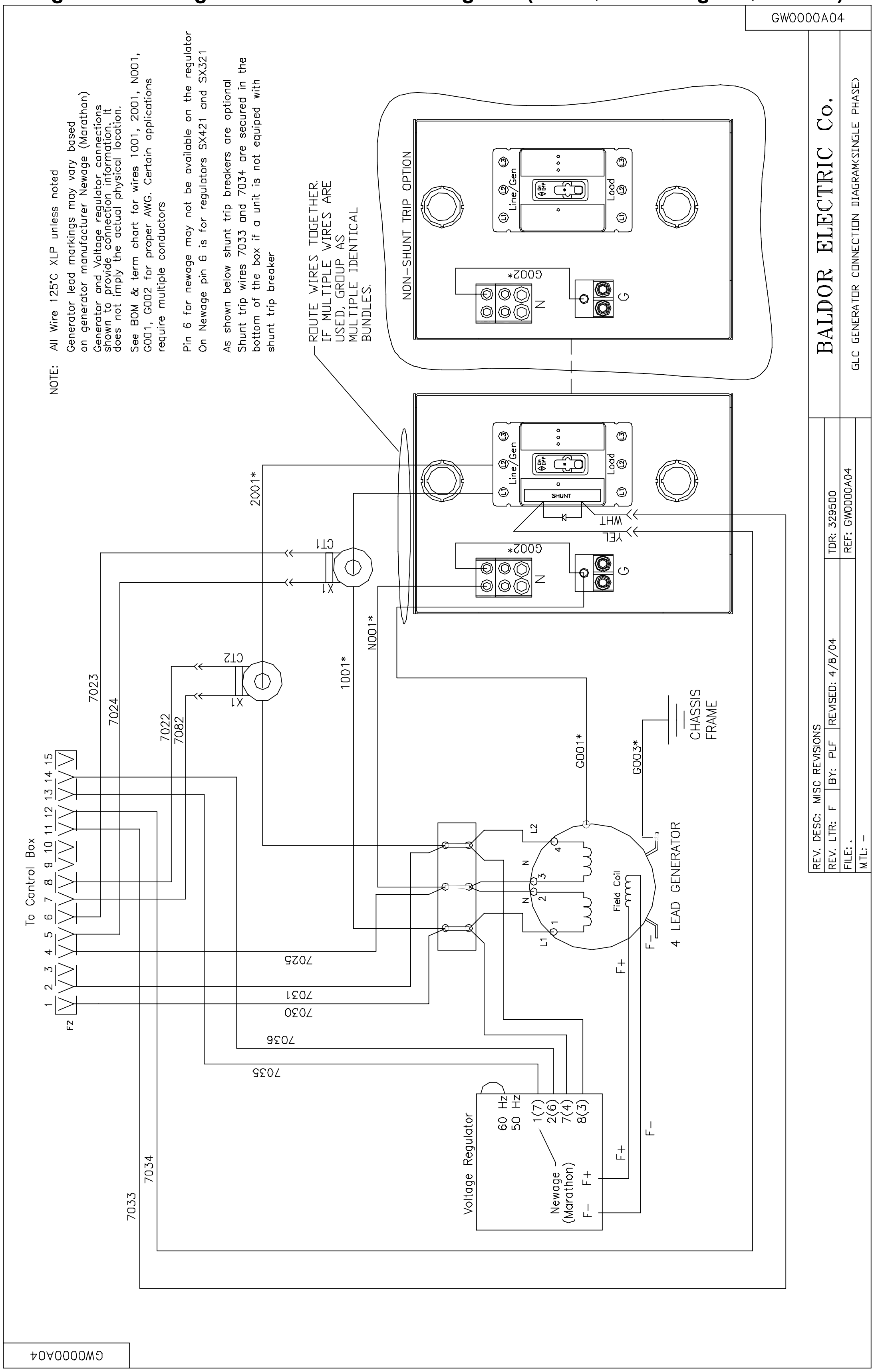


Figure B-17 Single Phase Connection Diagram (Wire 1/0 and Smaller w/Breaker)

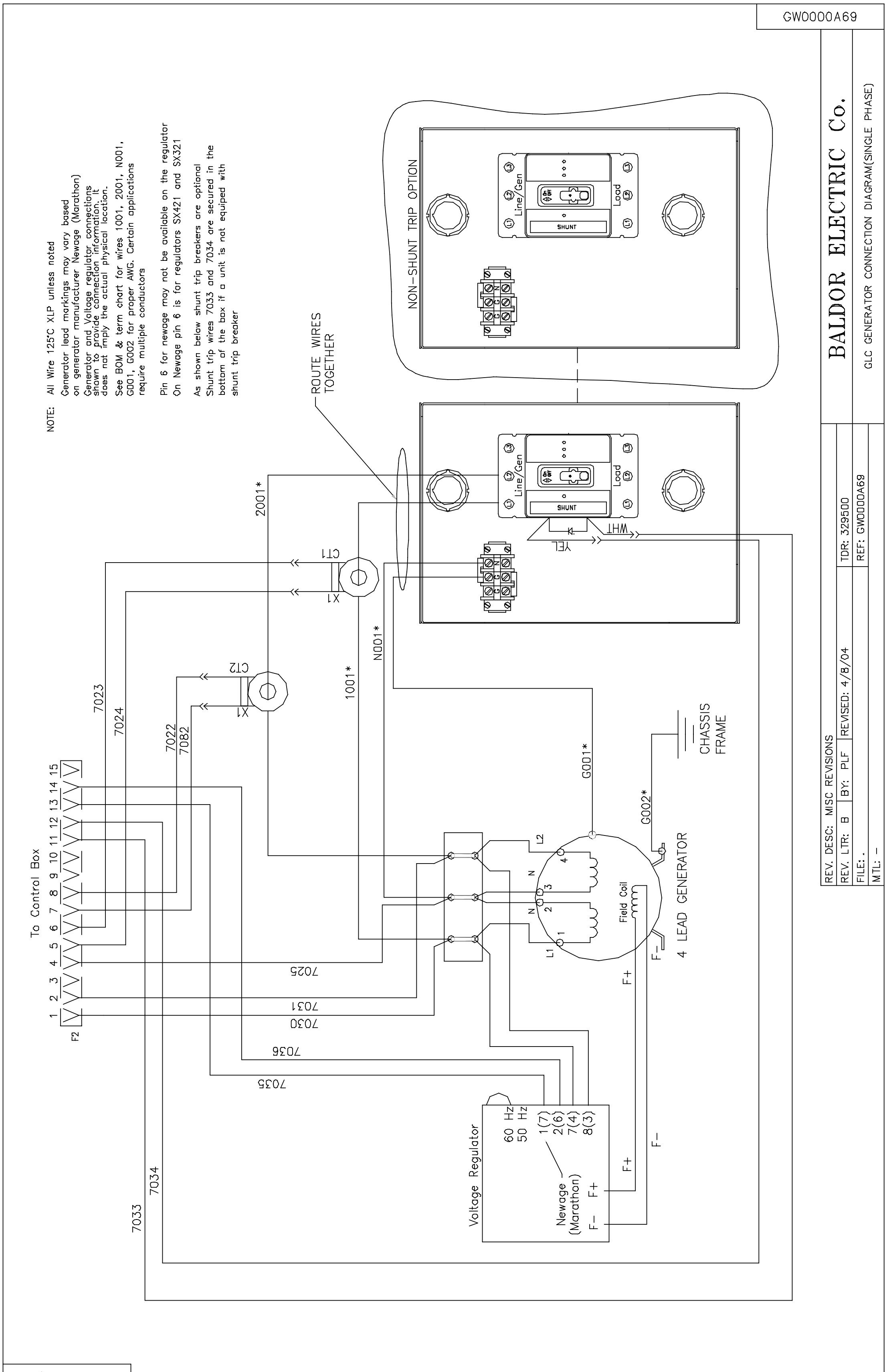


Figure B-18 Single Phase Connection Diagram (Wire 1/0 and Smaller w/o Breaker)

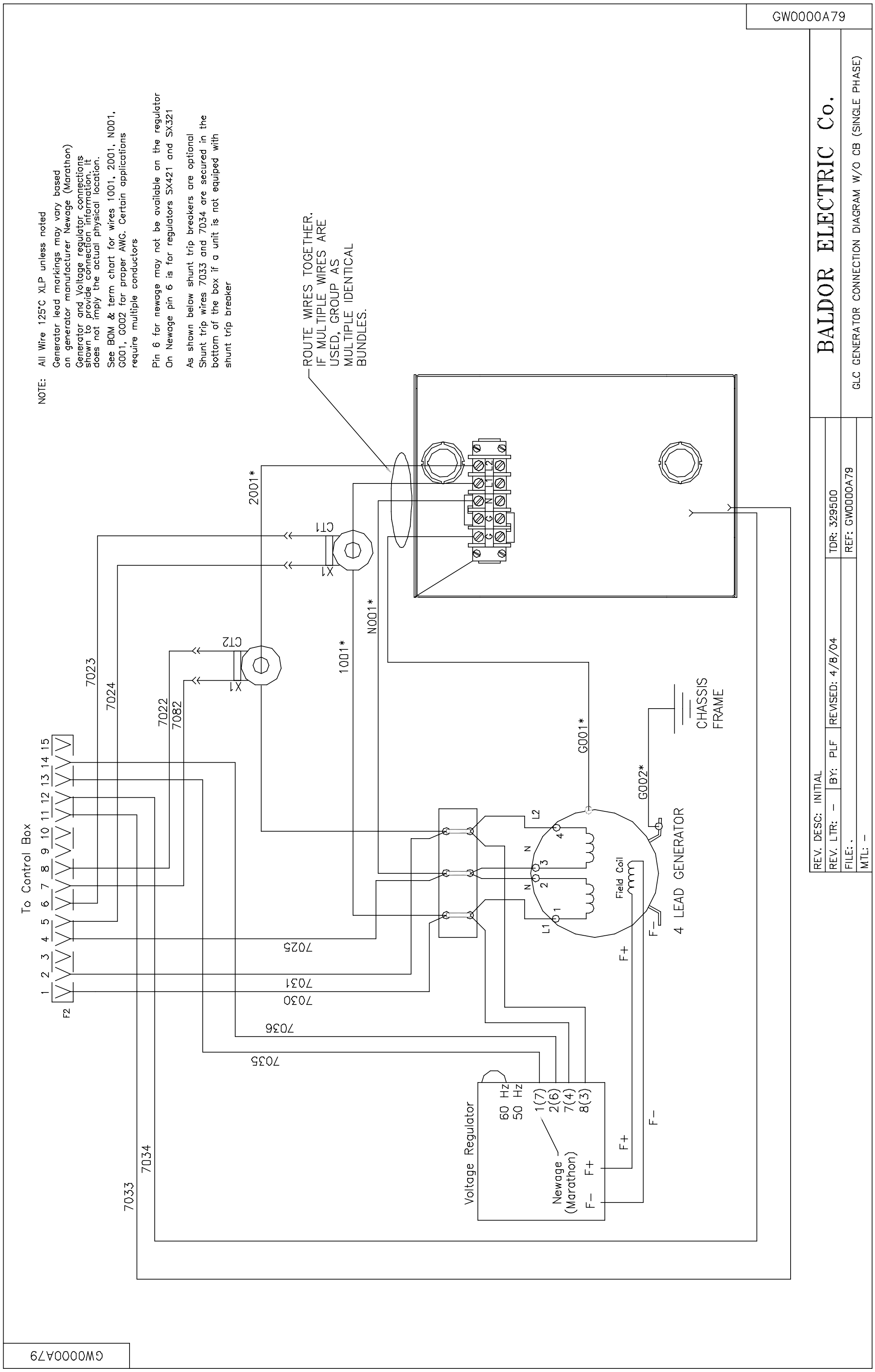


Figure B-19 Single Phase Connection Diagram (Wire Larger than 1/0 w/o Breaker)

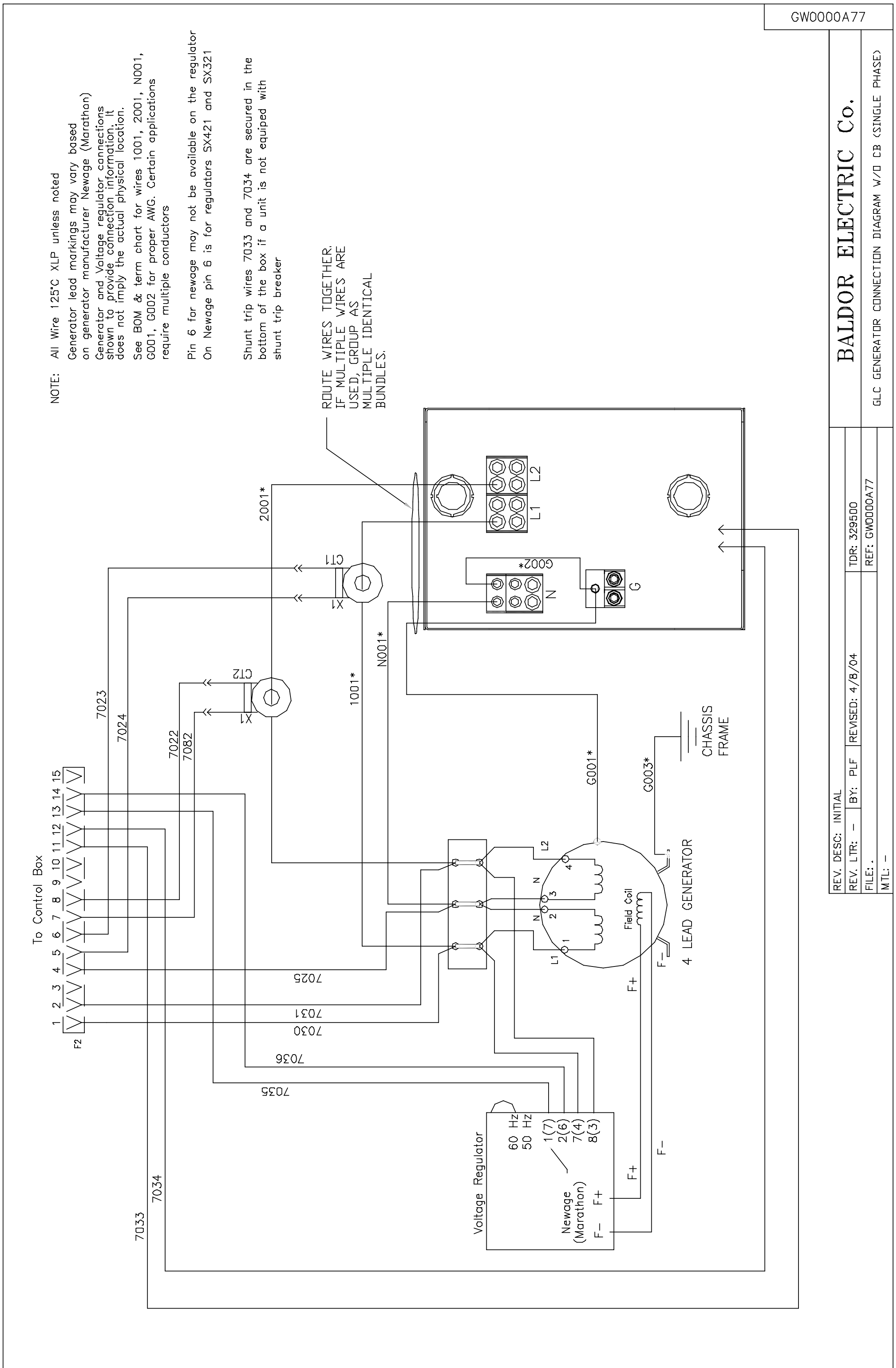


Figure B-20 Three Phase Connection Diagram

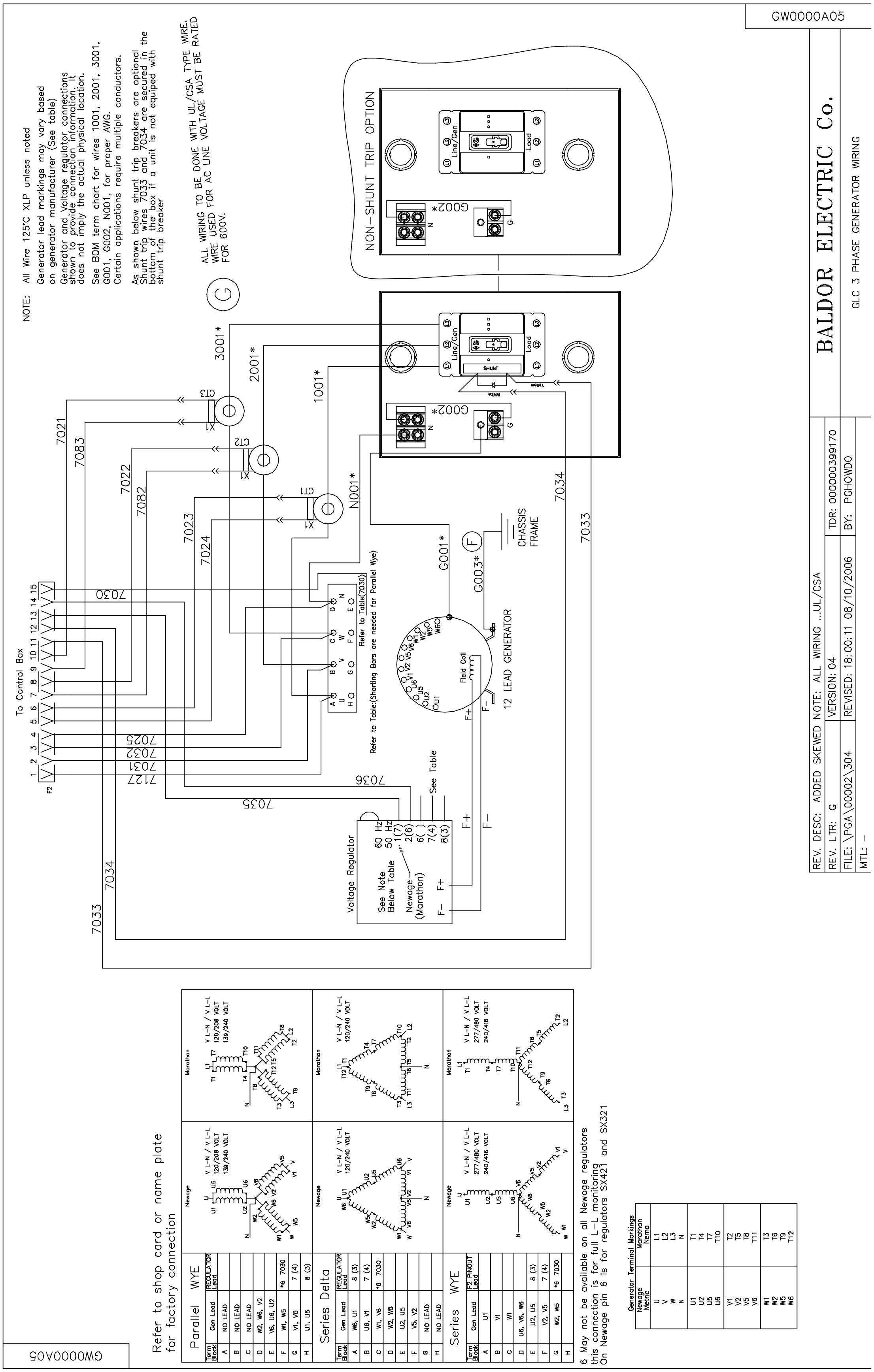


Figure B-21 Three Phase Connection Diagram with PMG

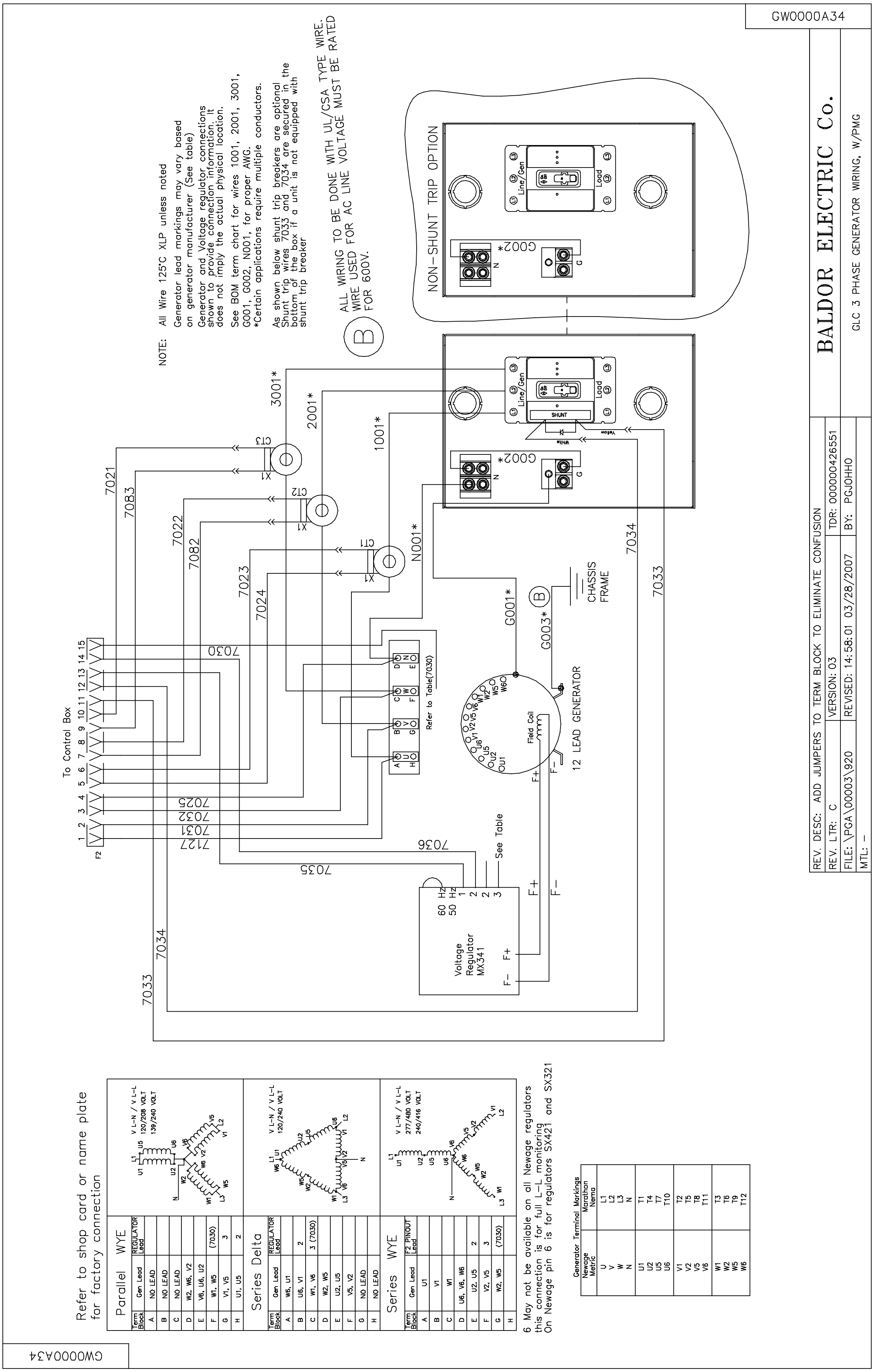


Figure B-22 Three Phase Connection Diagram (Wire 1/0 and larger)

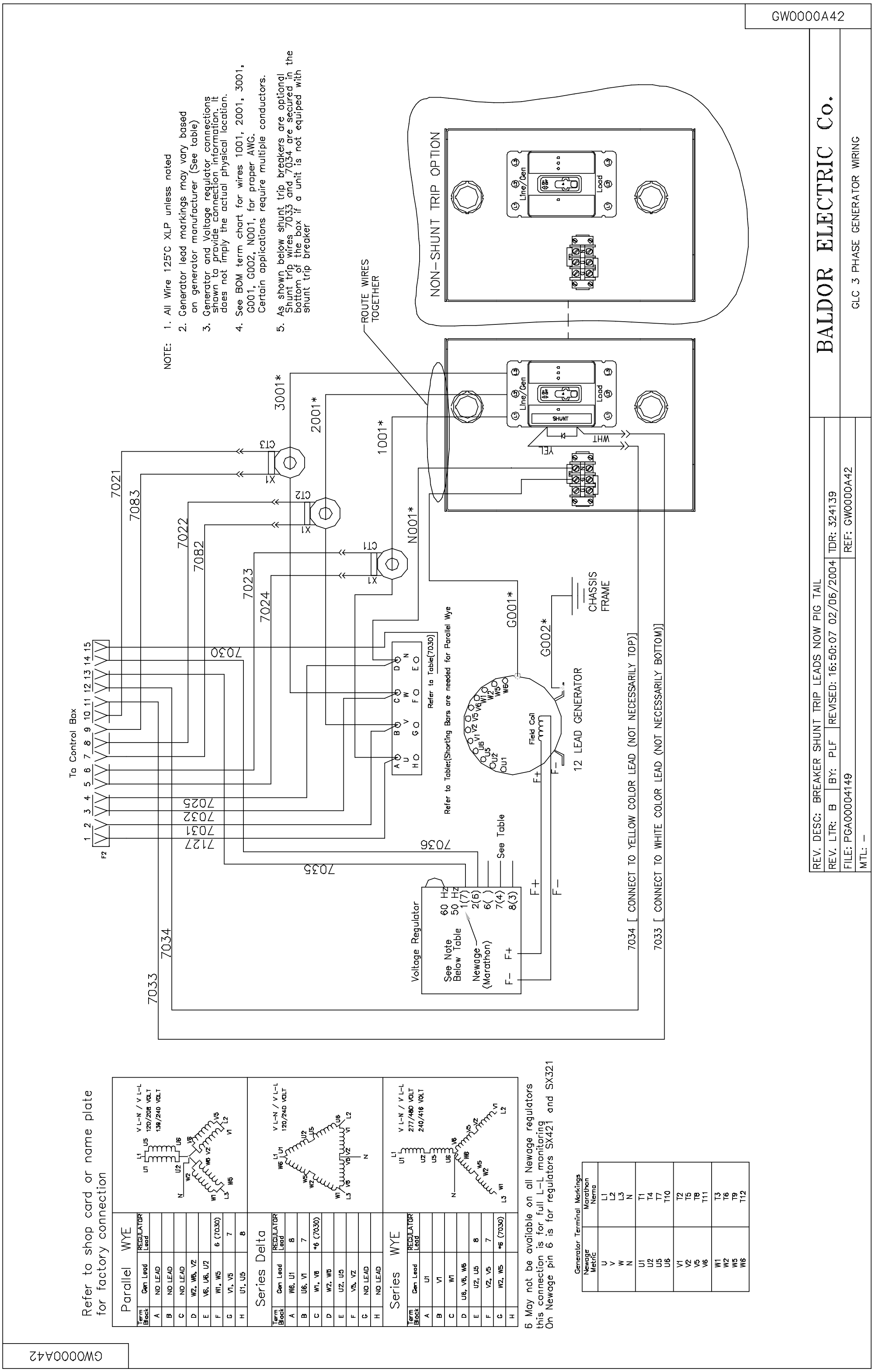


Figure B-23 Three Phase Connection Diagram (Wire Larger than 1/0 w/Breaker)

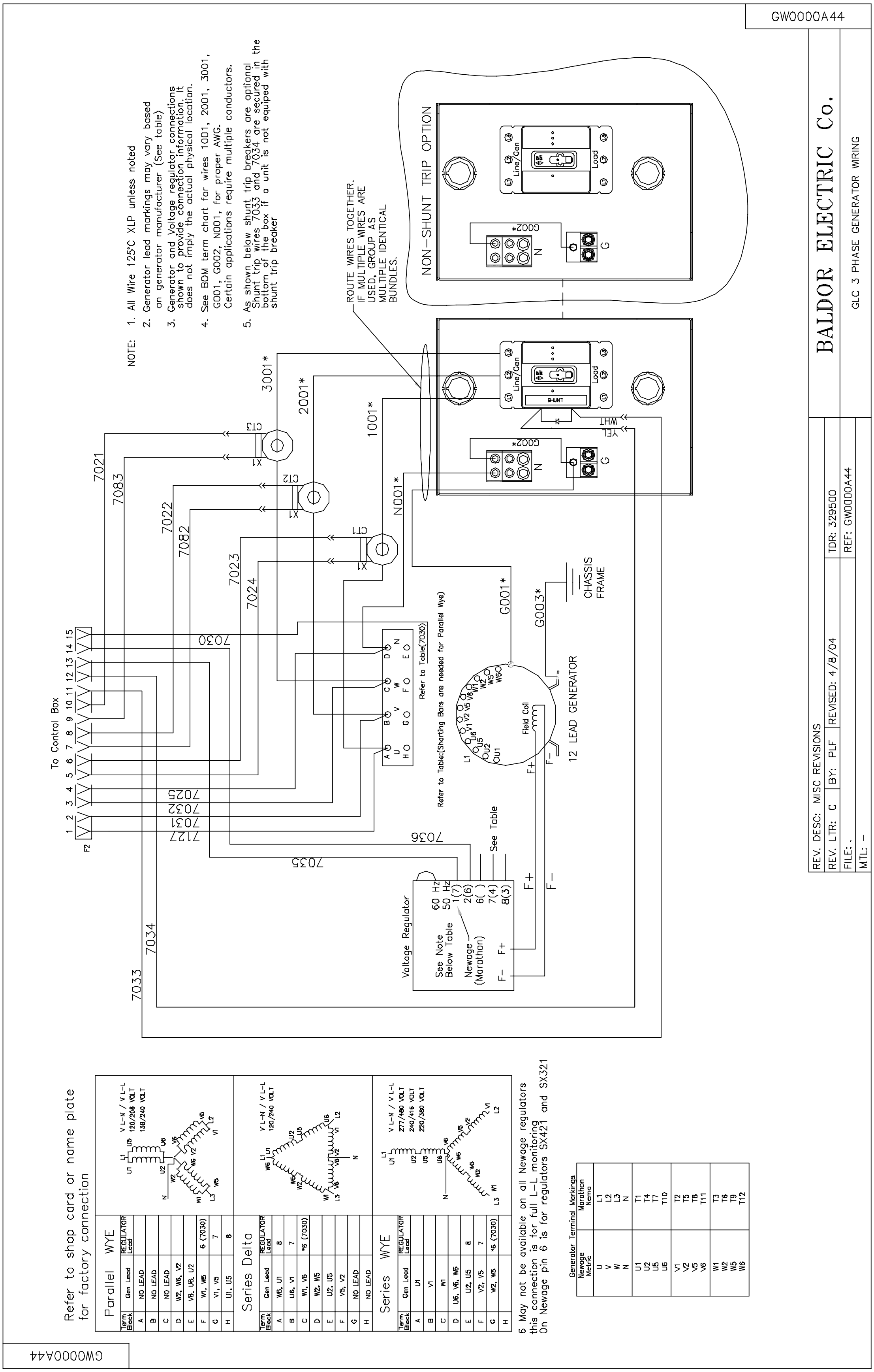


Figure B-24 Three Phase Connection Diagram (Wire 1/0 and Smaller w/Breaker)

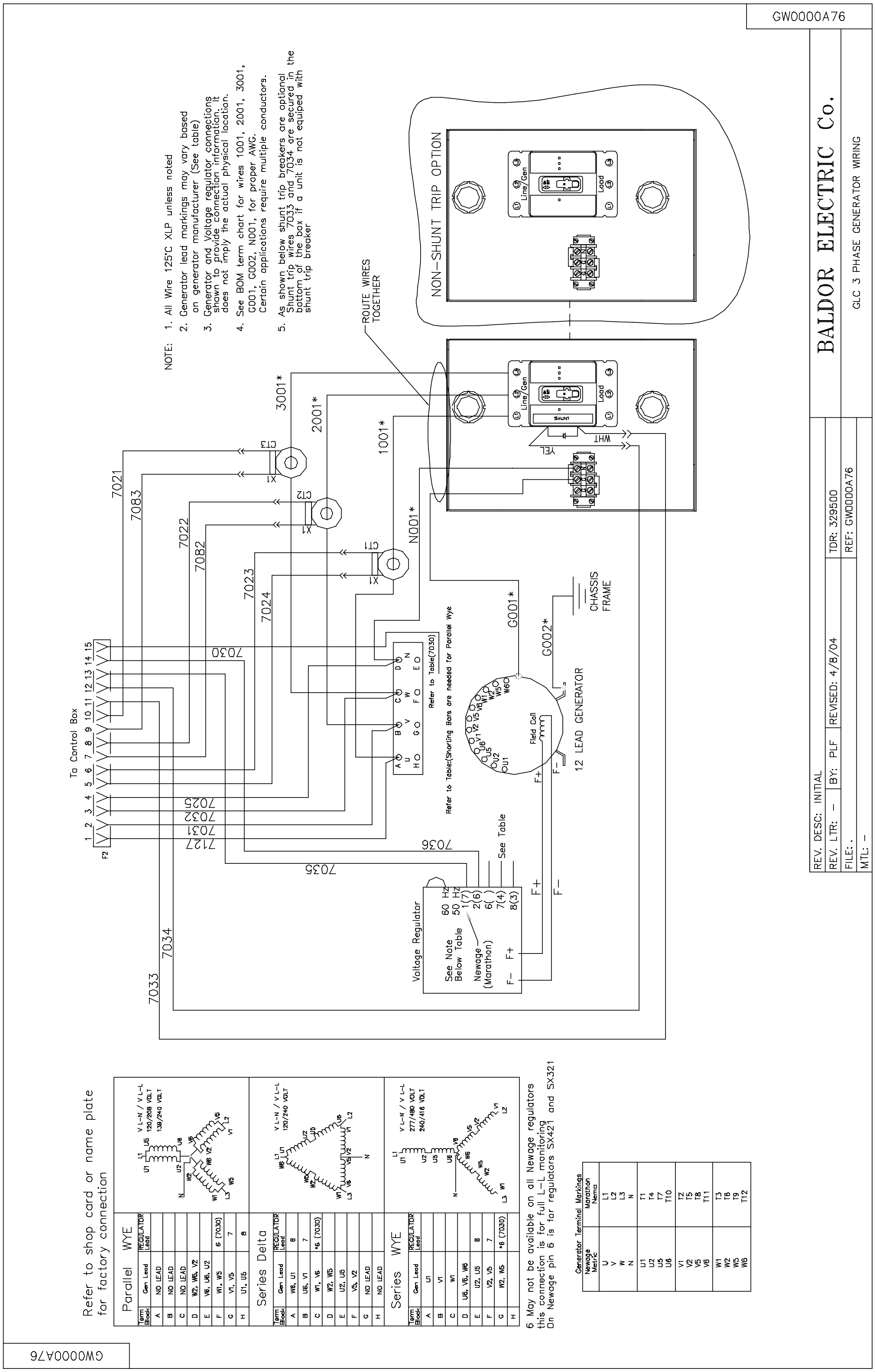


Figure B-25 Three Phase Connection Diagram (Wire Larger than 1/0 w/o Breaker)

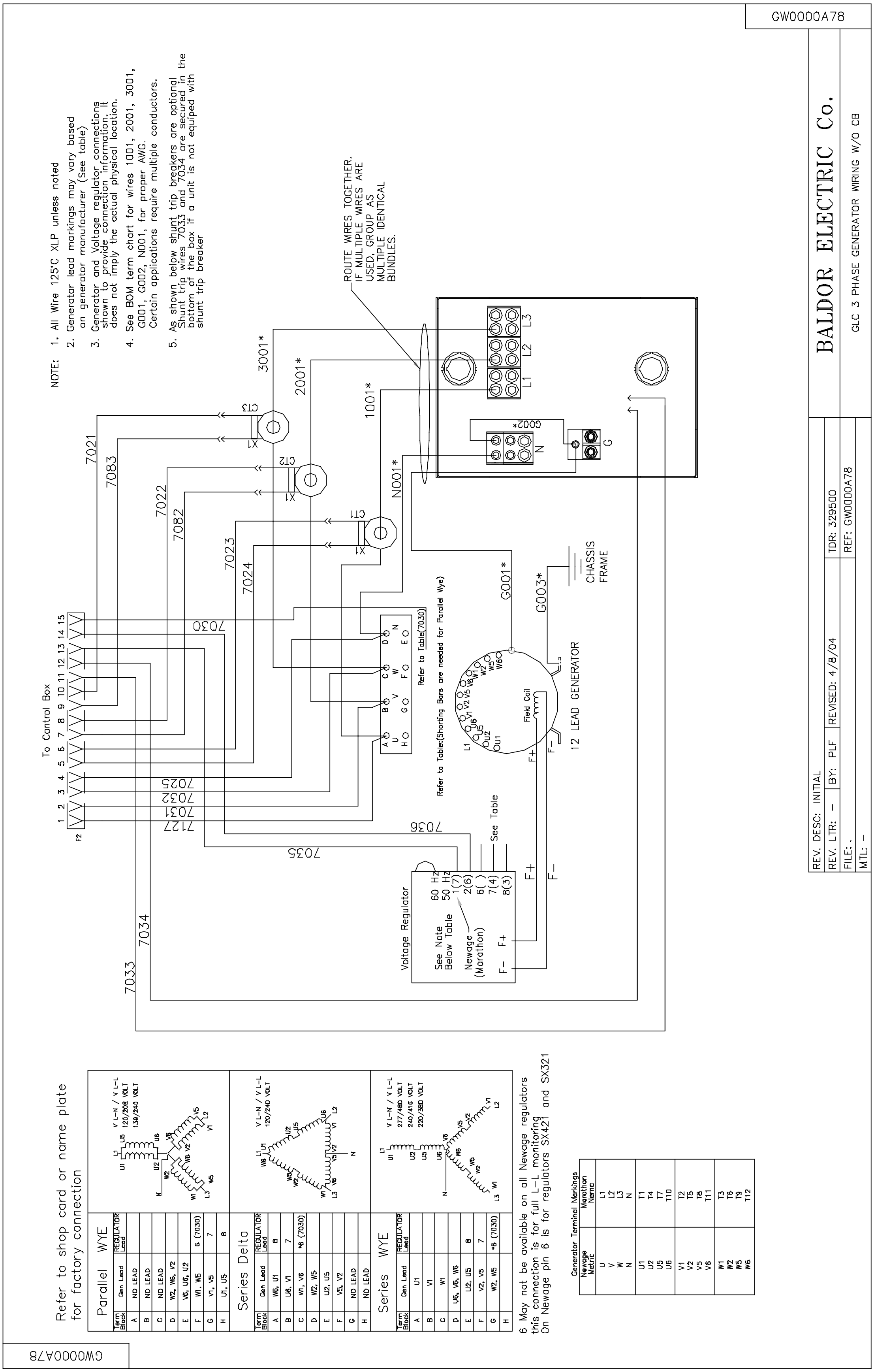


Figure B-26 Three Phase Connection Diagram (Wire 1/0 and Smaller w/o Breaker)

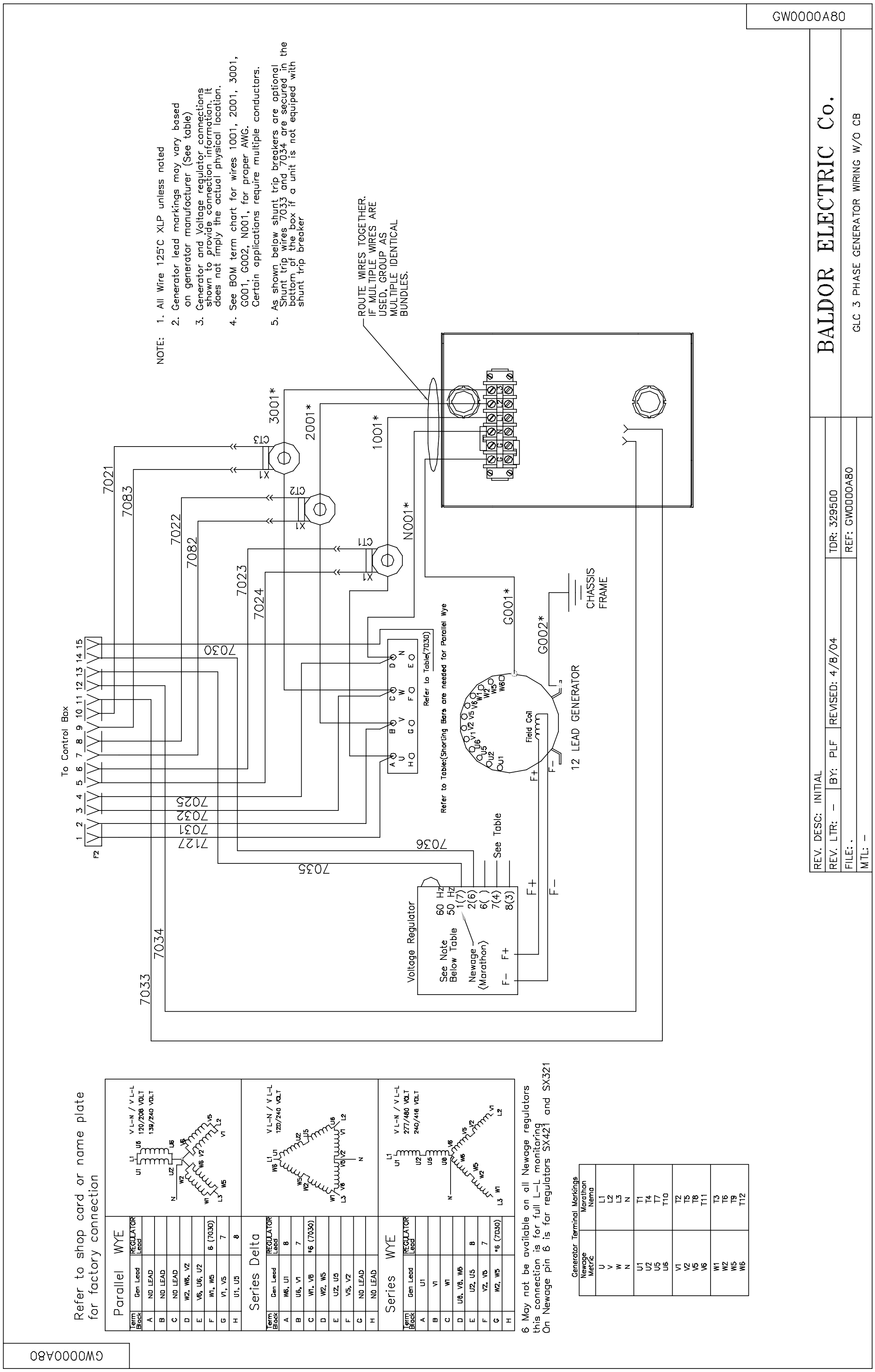


Figure B-27 Control Box Connections with MEC20 Controller

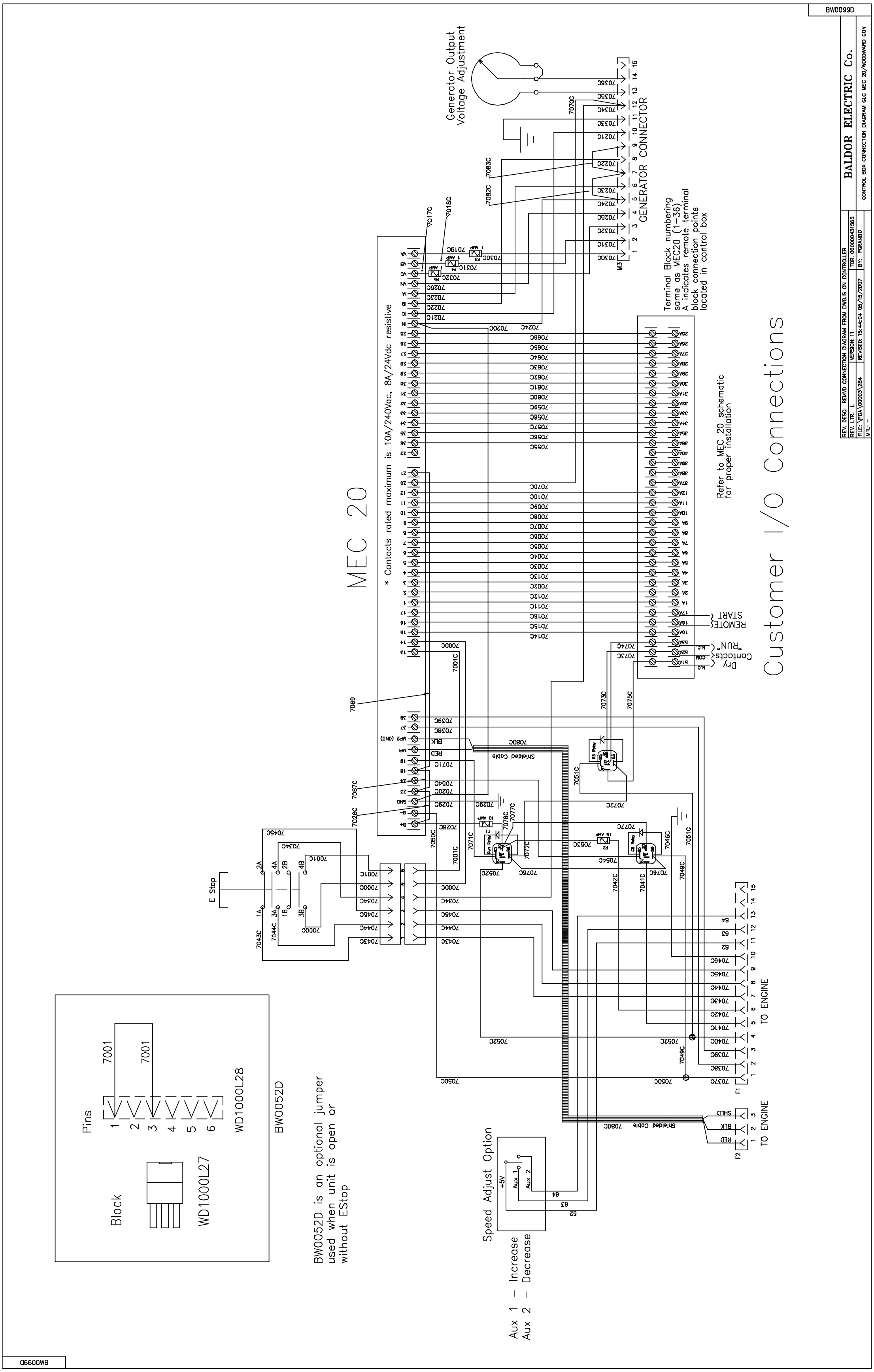


Figure B-28 Control Box Connections with MEC20 Controller & Governor

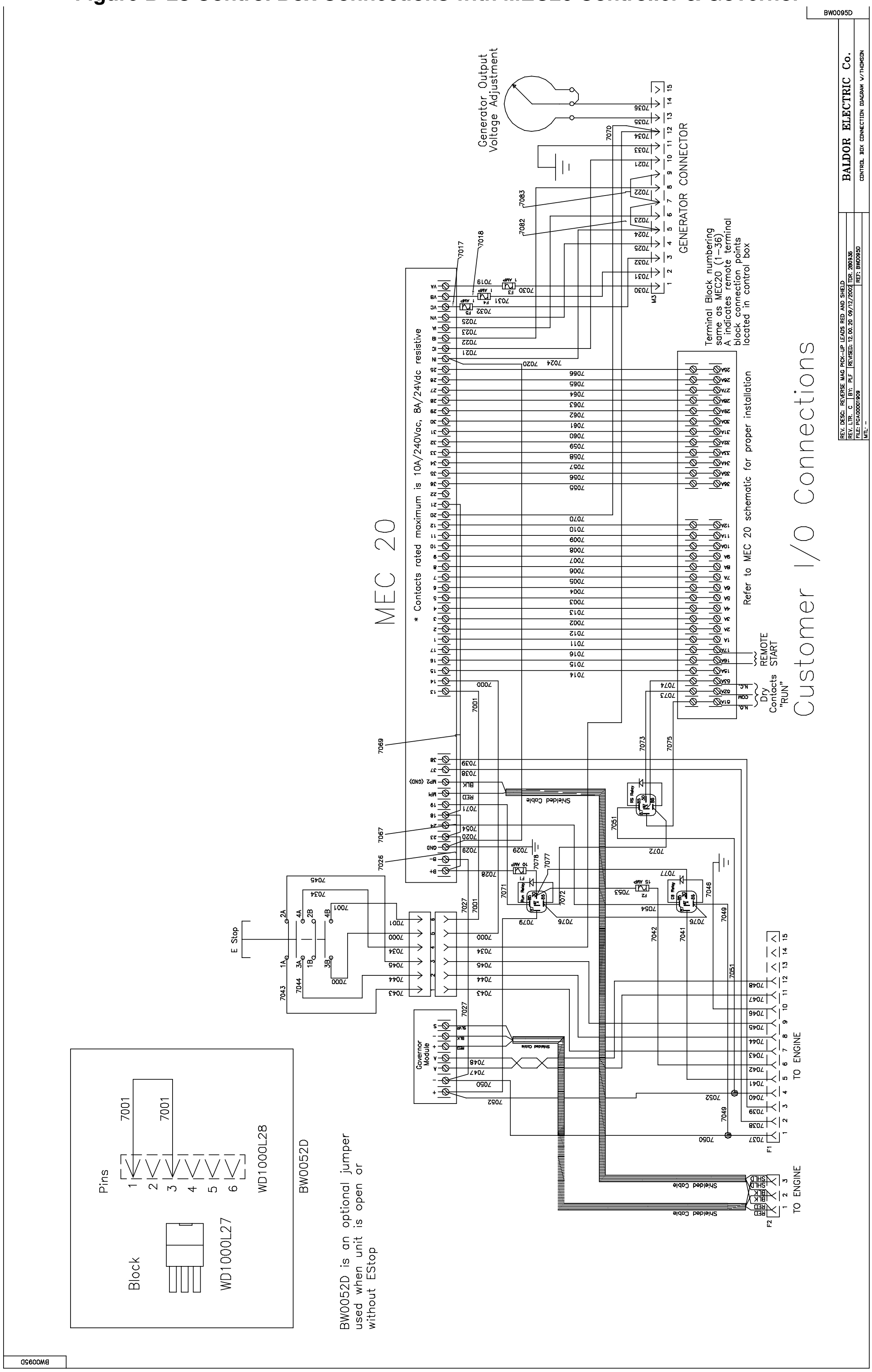


Figure B-29 Control Box Connections with MEC2 Controller

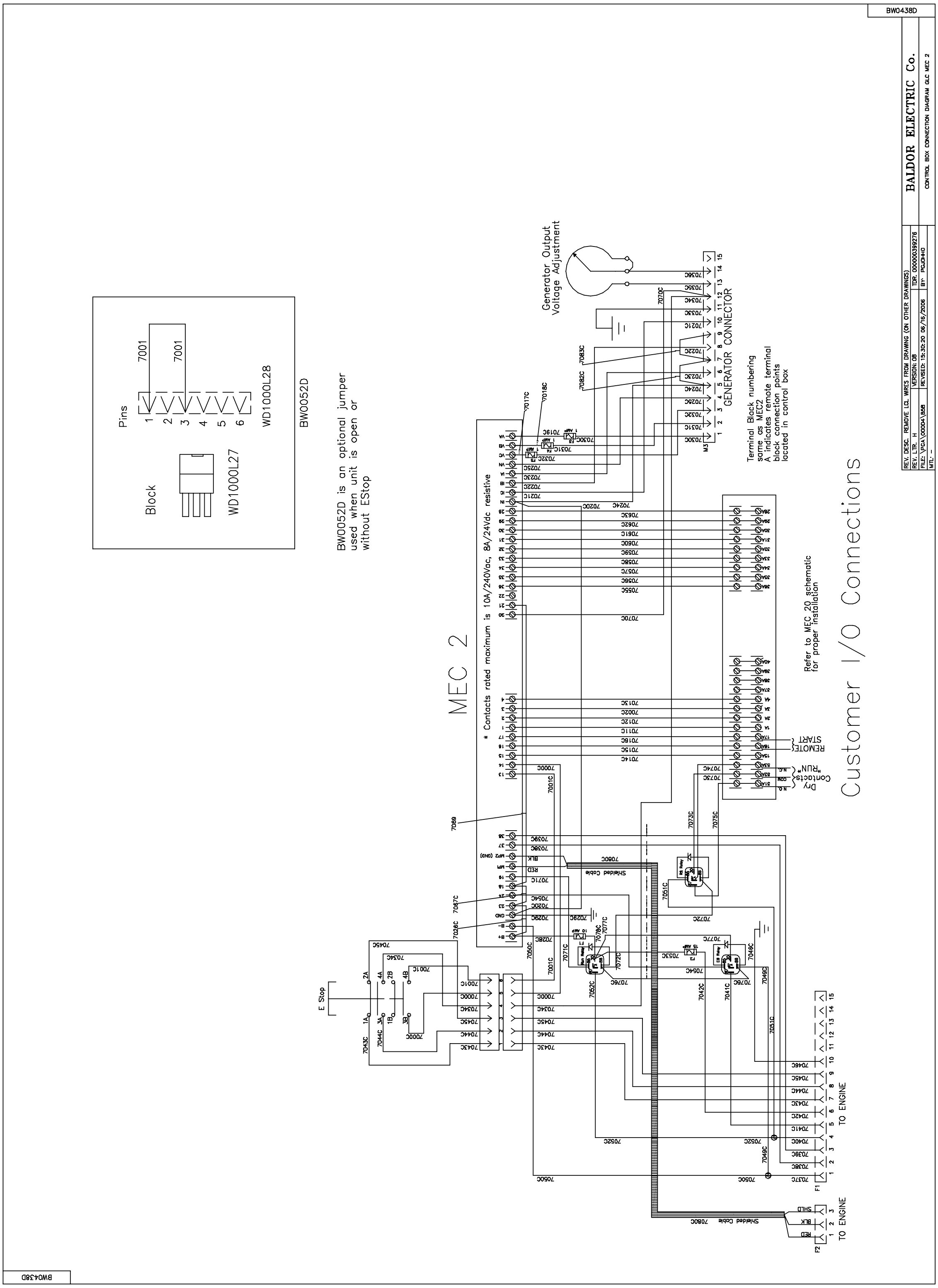


Figure B-30 Engine Wiring, Woodward 4.3L GM

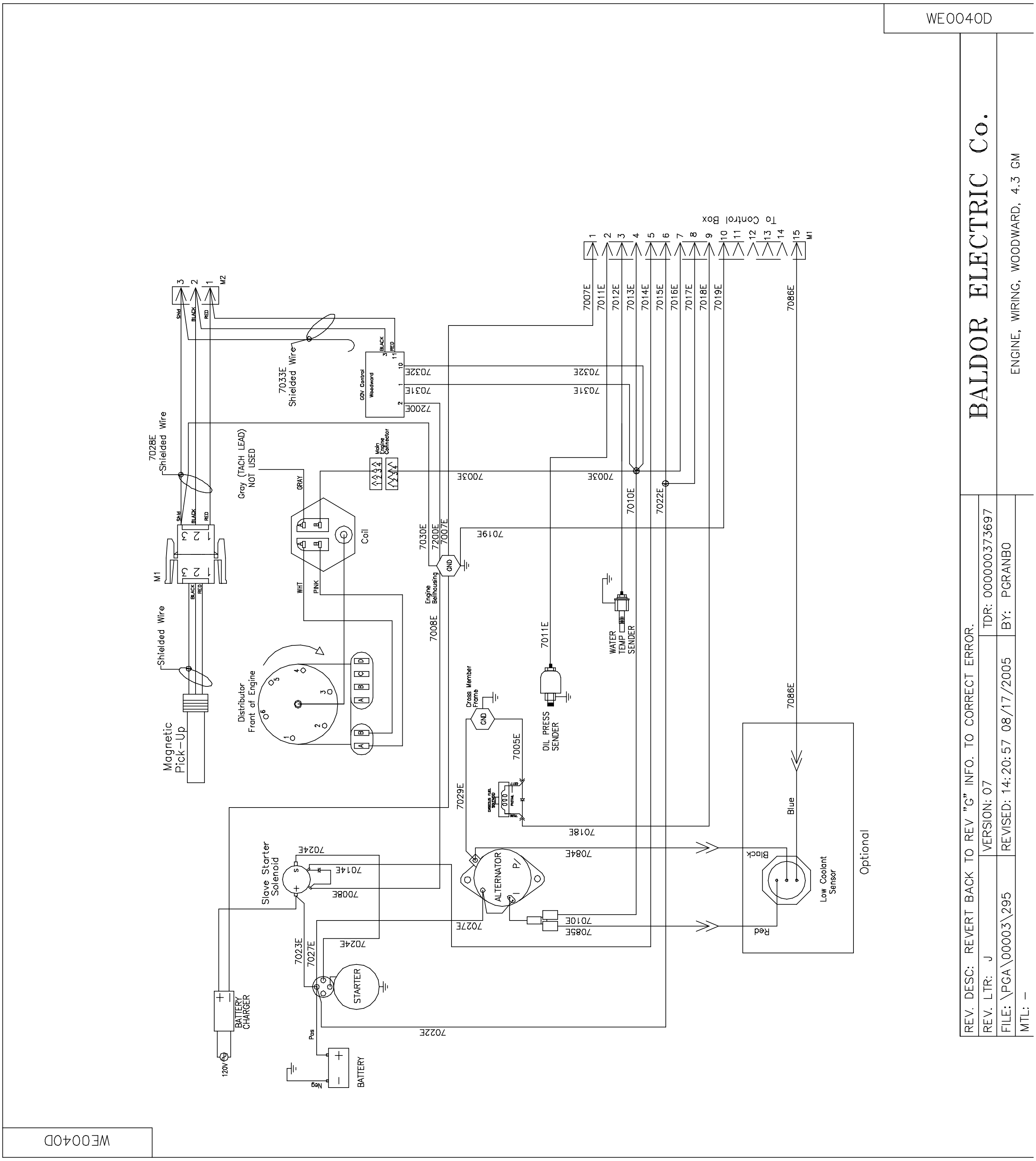


Figure B-31 Engine Wiring, Woodward 5.7L GM

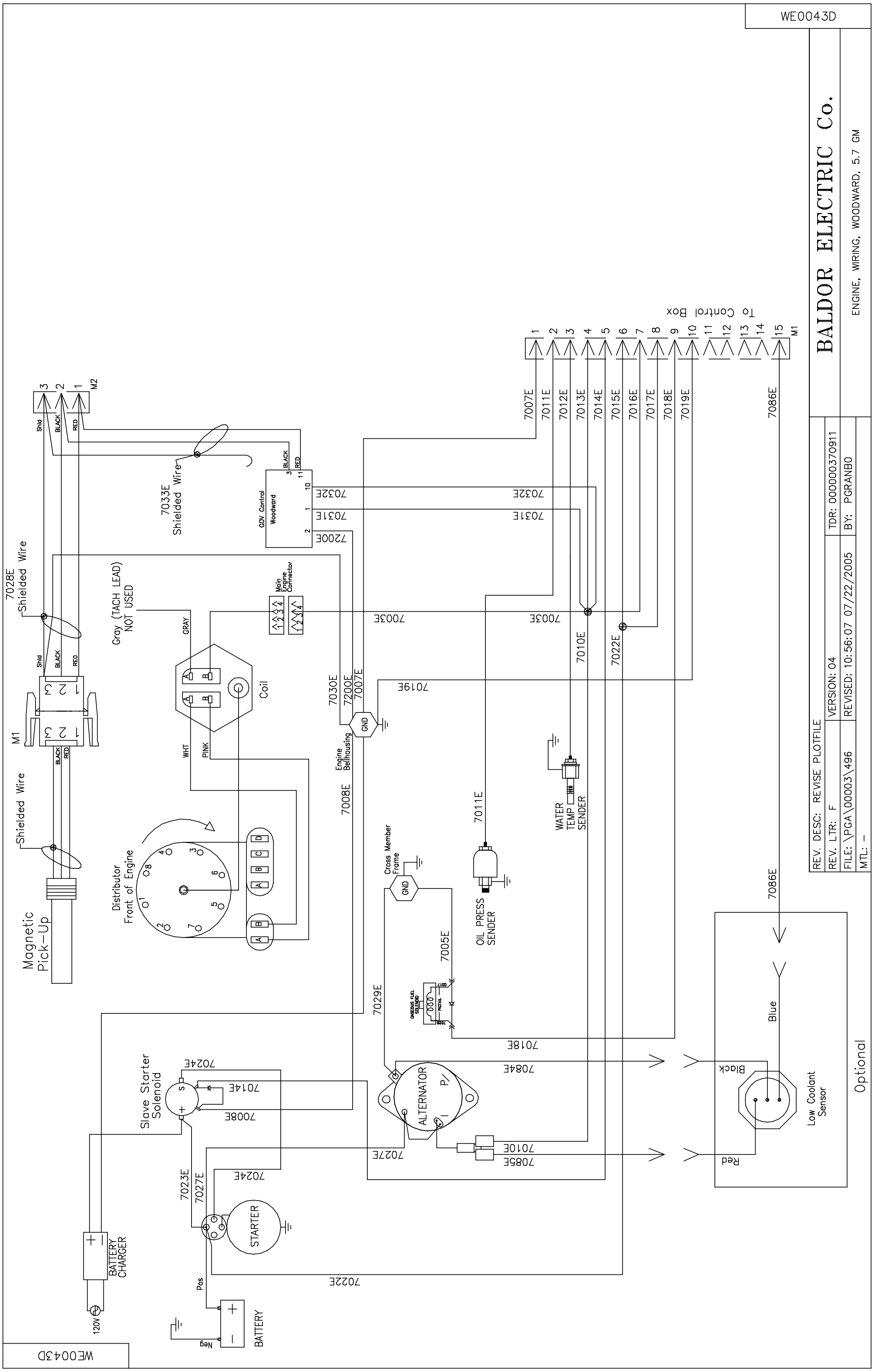
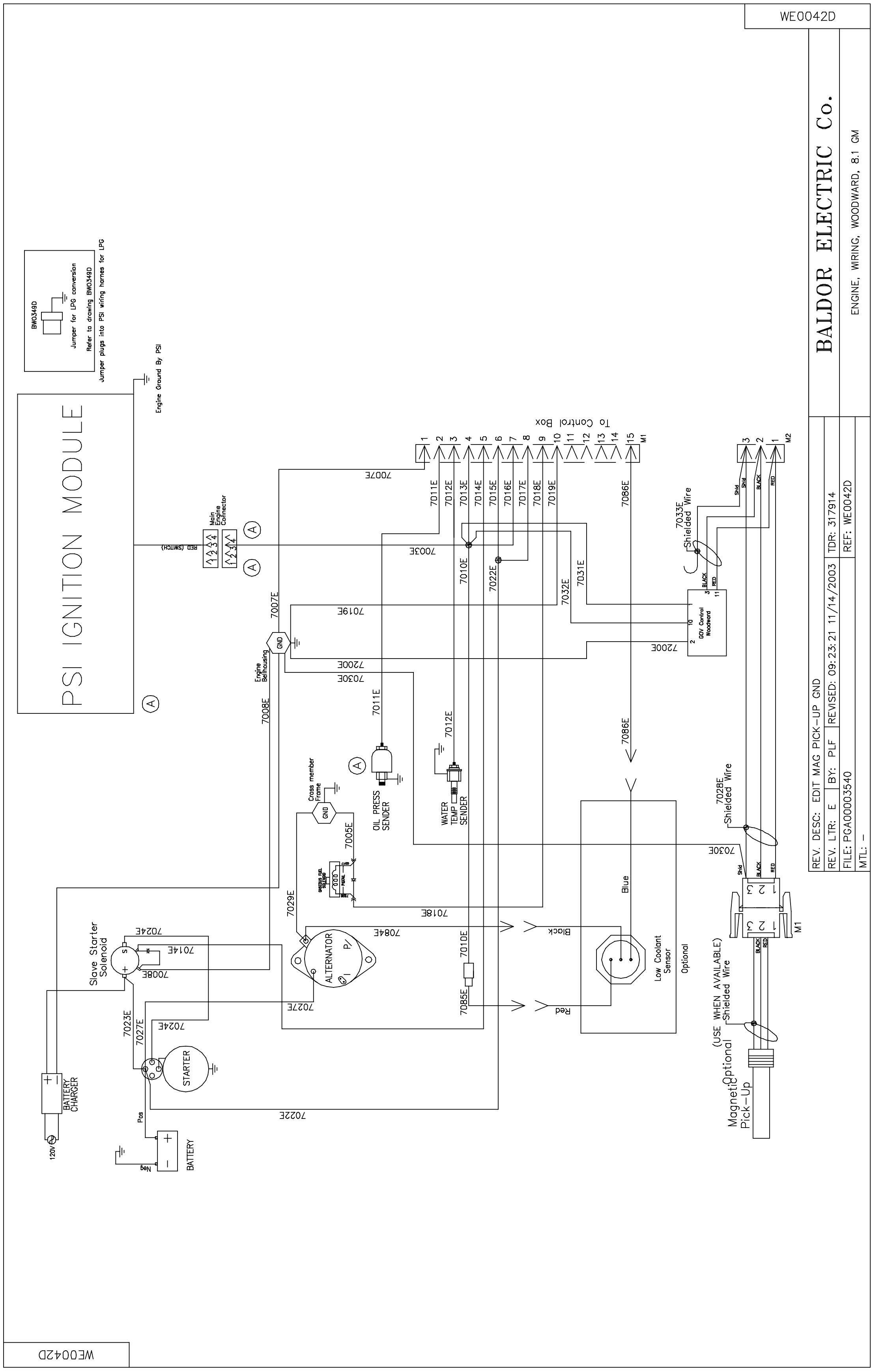


Figure B-32 Engine Wiring, Woodward 8.1L GM



Baldor District Offices

UNITED STATES

ARIZONA

PHOENIX
4211 S 43RD PLACE
PHOENIX, AZ 85040
PHONE: 602-470-0407
FAX: 602-470-0464

ARKANSAS

CLARKSVILLE
1001 COLLEGE AVE.
CLARKSVILLE, AR 72830
PHONE: 479-754-9108
FAX: 479-754-9205

CALIFORNIA

LOS ANGELES
6480 FLOTILLA
COMMERCE, CA 90040
PHONE: 323-724-6771
FAX: 323-721-5859

HAYWARD
21056 FORBES STREET
HAYWARD, CA 94545
PHONE: 510-785-9900
FAX: 510-785-9910

COLORADO

DENVER
3855 FOREST STREET
DENVER, CO 80207
PHONE: 303-623-0127
FAX: 303-595-3772

9980 PARK MEADOWS DRIVE
SUITE 214
LONE TREE, CO 80124-6739
PHONE: 303-339-9629
FAX: 303-339-9633

CONNECTICUT

WALLINGFORD
65 SOUTH TURNPIKE ROAD
WALLINGFORD, CT 06492
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FAX: 203-269-5485

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3906 EAST 11TH AVENUE
TAMPA, FL 33605
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5490 MCGINNIS FERRY PLACE
SUITE 133
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